



**1719 CIRCLE ROAD
POWDERSVILLE, SC 29642
PH: (864) 269-5440**

**WATER SYSTEM GUIDELINES
FOR
DESIGN AND CONSTRUCTION**

Revised June, 2022

INTRODUCTION

The Water System Guidelines for Design & Construction have been prepared to complement the Standard Detail Drawings and to provide the qualitative requirements for products, materials and workmanship for construction of additions to and replacements of the water distribution system which is to be operated by Powdersville Water. These Water System Guidelines for Design & Construction are to be used for projects with Drawings which have been approved by the South Carolina Department of Health and Environmental Control as prepared by Powdersville Water, by its design consultant, or by a developer's engineer, whose Drawings must first be approved by Powdersville Water. All references in these Water System Guidelines for Design & Construction to "Engineer" and "Owner" shall mean Powdersville Water. These Water System Guidelines for Design & Construction are subject to revision or modification for a specific project, with such revisions identified in the Bidding Requirements and Special Conditions document prepared by Powdersville Water or its design consultant, or with such revisions noted on the Drawings approved by Powdersville Water.

All work requirements described in the Water System Guidelines for Design & Construction are the responsibility of the Contractor, unless otherwise specifically designated.

BOARD:
Allen Amsler
Chairman
Mark S. Lutz
Vice Chairman



Catherine B. Templeton, Director

Promoting and protecting the health of the public and the environment

BOARD:
R. Kenyon Wells
L. Clarence Batts, Jr.
Ann B. Kiriol, DDS
John O. Hutto, Sr., MD

December 10, 2013

MR. CHRIS RASCO
POWDERSVILLE WATER DISTRICT
1719 CIRCLE ROAD
POWDERSVILLE, SC 29642

RE: Powdersville Water District
"Water System Guidelines for Design and Construction"
Approval Number SS-002022; Approval Date: 12/10/13

This Office has reviewed the document "Water System Guidelines for Design and Construction" (Revised May 2013) for consideration and use as approved Standard Specifications on file with the Department. This Office received the document on December 09, 2013 via a transmittal letter (Chris Rasco to Wayne Stokes) dated December 03, 2013. Based on our review, this letter may serve as your approval of this document for use as Standard Specifications. These approved standard specifications do not apply to water storage tanks or water pumps.

For further submittals of projects, please indicate on the application for permit to construct that your specifications have been approved as Standard Specifications and that no additional copies will be necessary.

If you have any questions, please call me at 803-898-3396.

Sincerely,

Alan Coffey
Construction Permitting Section
Stormwater, Construction, and Agricultural Permitting Division
Bureau of Water

Water System Guidelines for Design & Construction

Division 1 – General Requirements

<u>Section</u>	<u>Title</u>
01340	Shop Drawings, Product Data and Samples

Division 2 – Site Work

<u>Section</u>	<u>Title</u>
02110	Clearing and Grubbing
02125	Soil Erosion and Sediment Control
02225	Trench Excavation and Backfill
02229	Bore and Jack Casings
02575	Removing and Replacing Pavement
02665	Water Mains and Accessories
02668	Water Service Connections
02772	Fire Line Connections
Appendix A	Approved Manufacturers List

STANDARD DETAIL DRAWINGS

STD-G-01	Reinforced Silt Fence
STD-G-02	Concrete Encasement
STD-G-03	Trench Terminology
STD-G-04	Concrete Pavement Replacement
STD-G-05	Asphalt Pavement Replacement
STD-G-06	Pipe Bedding and Haunching
STD-G-07	Bore and Jack
STD-G-08	Stub Out Detail
STD-G-09	Stub Out Under Ditch to Property Line
STD-G-10	Agave Tracer Wire
STD-G-11	Typical Fitting & Joint Restraint for 4" and Above
STD-W-01	Typical ¾" or 1" Water Service & Meter Connection
STD-W-02	1-1/2" & 2" Water Service & Meter Connection
STD-W-03	3"-4" Water Service & Meter Connection
STD-W-04	Typical Fire Hydrant Assembly
STD-W-05	Fire Hydrant Under Ditch
STD-W-06	Gate Valve
STD-W-07	Butterfly Valve
STD-W-08	Extension Stem
STD-W-09	Automatic Air Release Valve
STD-W-10	Residential Tap Placement
STD-W-11	Multiple Meter Header Assembly
STD-W-12	Typical Blow-Off Assembly
STD-W-13	Auto-Flushing Device Detail
STD-W-14	Reduced Pressure or Double Check Valve Assembly Backflow Preventor
STD-W-15	Double Check Valve Assembly
STD-W-16	Fire Protection Vault with FDC
STD-W-17	Metered Fire Line
STD-W-18	Cul-de-sac Detail
STD-W-19	Fence Detail

Part 1 General**1.01 Scope**

- A. The work under this Section includes submittal to the Engineer of shop drawings, product data and samples required by the various sections of these Specifications.
- B. Submittal Contents: The submittal contents required are specified in each section.
- C. Definitions: Submittals are categorized as follows:
 - 1. Shop Drawings
 - a. Shop drawings shall include technical data, drawings, diagrams, procedure and methodology, performance curves, schedules, templates, patterns, test reports, calculations, instructions, measurements and similar information as applicable to the specific item for which the shop drawing is prepared.
 - b. Provide newly-prepared information, on reproducible sheets, with graphic information at accurate scale (except as otherwise indicated) or appropriate number of prints hereof, with name or preparer (firm name) indicated. The Contract Drawings shall not be traced or reproduced by any method for use as or in lieu of detail shop drawings. Show dimensions and note dimensions that are based on field measurement. Identify materials and products in the work shown. Indicate compliance with standards and special coordination requirements. Do not allow shop drawings to be used in connection with the Work without appropriate final "Action" markings by the Engineer.
 - c. Drawings shall be presented in a clear and thorough manner. Details shall be identified by reference to sheet and detail, specification section, schedule or room numbers shown on the Contract Drawings.
 - d. Minimum assembly drawings sheet size shall be 24 x 36-inches.
 - e. Minimum detail sheet size shall be 8-1/2 x 11-inches.
 - f. Minimum Scale:
 - (1) Assembly Drawings Sheet, Scale: 1-inch = 30 feet.
 - (2) Detail Sheet, Scale: 1/4-inch = 1 foot.
 - g. In addition to paper copies, electronic copies of drawing shall be delivered in PDF and AutoCAD format, if requested.

2. Product Data

- a. Product data includes standard printed information on materials, products and systems, not specially prepared for this Project, other than the designation of selections from among available choices printed therein.
- b. Collect required data into one submittal for each unit of work or system, and mark each copy to show which choices and options are applicable to the Project. Include manufacturer's standard printed recommendations for application and use, compliance with standards, application of labels and seals, notation of field measurements which have been checked and special coordination requirements.

3. Samples

- a. Samples include both fabricated and un-fabricated physical examples of materials, products and units of work, both as complete units and as smaller portions of units of work, either for limited visual inspection or, where indicated, for more detailed testing and analysis.
- b. Provide units identical with final condition of proposed materials or products for the work. Include "range" samples, not less than three units, where unavoidable variations must be expected, and describe or identify variations between units of each set. Provide full set of optional samples where the Engineer's selection is required. Prepare samples to match the Engineer's sample where indicated. Include information with each sample to show generic description, source or product name and manufacturer, limitations and compliance with standards. Samples are submitted for review and confirmation of color, pattern, texture and "kind" by the Engineer. Engineer will note "test" samples, except as otherwise indicated, for other requirements, which are the exclusive responsibility of the Contractor.

- 4. Miscellaneous submittals related directly to the Work (non-administrative) include warranties, maintenance agreements, workmanship bonds, project photographs, survey data and reports, physical work records, statements of applicability, quality testing and certifying reports, copies of industry standards, record drawings, field measurement data, operating and maintenance materials, overrun stock, security/protection/safety keys and similar information, devices and materials applicable to the Work but not processed as shop drawings, product data or samples.

1.02 Specific Category Requirements

- A. General: Except as otherwise indicated in the individual work sections, comply with general requirements specified herein for each indicated category of submittal. Submittals shall contain:
1. The date of submittal and the dates of any previous submittals.
 2. The Project title.
 3. Numerical submittal numbers, starting with 1.0, 2.0, etc. Revisions to be numbered 1.1, 1.2, etc.
 4. The Names of:
 - a. Contractor
 - b. Supplier
 - c. Manufacturer
 5. Identification of the product, with the Specification section number, permanent equipment tag numbers and applicable Drawing No.
 6. Field dimensions, clearly identified as such.
 7. Relation to adjacent or critical features of the Work or materials.
 8. Applicable standards, such as ASTM or Federal Specification numbers.
 9. Notification to the Engineer in writing, at time of submissions, of any deviations on the submittals from requirements of the Contract Documents. The notification of deviation shall be clearly marked by the Contractor in the body of the submittal and stated in text in the Contractor's remarks on the transmittal document of the submittal. Indicate the reasons for the deviations and the benefits to the Project.
 10. Identification of revisions on resubmittals.
 11. An 8 x 3-inch blank space for Contractor and Engineer stamps.
 12. Contractor's stamp, initialed or signed, certifying to review of submittal, verification of products, field measurements and field construction criteria and coordination of the information within the submittal with requirements of the Work and of Contract Documents.
 13. Submittal sheets or drawings showing more than the particular item under consideration shall have all but the pertinent description of the item for which review is requested crossed out.

1.03 Routing of Submittals

- A. Submittals and routine correspondence shall be routed as follows:
1. Supplier to Contractor (through representative if applicable)
 2. Contractor to Engineer
 3. Engineer to Contractor and Owner
 4. Contractor to Supplier

Part 2 Products

2.01 Shop Drawings

- A. Unless otherwise specifically directed by the Engineer, make all shop drawings accurately to a scale sufficiently large to show all pertinent features of the item and its method of connection to the Work.
- B. Submit all shop assembly drawings, larger than 11 x 17-inches, in the form of one reproducible transparency with two opaque prints or bluelines.
- C. Submit all shop drawings, 11 x 17-inches and smaller, in the form of six opaque prints or bluelines.
- D. One reproducible for all submittals larger than 11 x 17-inches and no more than three prints of other submittals will be returned to the Contractor.
- E. Submit drawings in PDF or AutoCAD format if requested.

2.02 Manufacturer's Literature

- A. Where content of submitted literature from manufacturers includes data not pertinent to this submittal, clearly indicate which portion of the contents is being submitted for the Engineer's review.
- B. Submit the number of copies which are required to be returned (not to exceed three) plus three copies which will be retained by the Engineer.
- C. Contractor shall maintain a copy of all manufacturer's installation guidelines at the job site.

2.03 Samples

- A. Samples shall illustrate materials, equipment or workmanship and established standards by which completed work is judged.
- B. Unless otherwise specifically directed by the Engineer, all samples shall be of the precise article proposed to be furnished.
- C. Submit all samples in the quantity which is required to be returned plus one sample which will be retained by the Engineer.

2.04 Colors

- A. Unless the precise color and pattern is specifically described in the Contract Documents, wherever a choice of color or pattern is available in a specified product, submit accurate color charts and pattern charts to the Engineer for review and selection.

- B. Unless all available colors and patterns have identical costs and identical wearing capabilities, and are identically suited to the installation, completely describe the relative costs and capabilities of each.

Part 3 Execution

3.01 Contractor's Coordination of Submittals

- A. Prior to submittal for the Engineer's review, the Contractor shall use all means necessary to fully coordinate all material, including the following procedures:
 - 1. Determine and verify all field dimensions and conditions, catalog numbers and similar data.
 - 2. Coordinate as required with all trades and all public agencies involved.
 - 3. Submit a written statement of review and compliance with the requirements of all applicable technical Specifications as well as the requirements of this Section.
 - 4. Clearly indicate in a letter or memorandum on the manufacturer's or fabricator's letterhead, all deviations from the Contract Documents.
- B. Each and every copy of the shop drawings and data shall bear the Contractor's stamp showing that they have been so checked. Shop drawings submitted to the Engineer without the Contractor's stamp will be returned to the Contractor for conformance with this requirement.
- C. The Owner may backcharge the Contractor for costs associated with having to review a particular shop drawing, product data or sample more than two times to receive a "No Exceptions Taken" mark.
- D. Grouping of Submittals
 - 1. Unless otherwise specifically permitted by the Engineer, make all submittals in groups containing all associated items.
 - 2. No review will be given to partial submittals of shop drawings for items which interconnect and/or are interdependent. It is the Contractor's responsibility to assemble the shop drawings for all such interconnecting and/or interdependent items, check them and then make one submittal to the Engineer along with Contractor's comments as to compliance, non-compliance or features requiring special attention.
- E. Schedule of Submittals
 - 1. Within 30 days of Contract award and prior to any shop drawing submittal, the Contractor shall submit a schedule showing the estimated date of submittal and the desired approval date for each shop drawing anticipated. A reasonable period shall be scheduled for review and comments. Time lost due to

unacceptable submittals shall be the Contractor's responsibility and some time allowance for resubmittal shall be provided. The schedule shall provide for submittal of items which relate to one another to be submitted concurrently.

3.02 Timing of Submittals

- A. Make all submittals far enough in advance of scheduled dates for installation to provide all required time for reviews, for securing necessary approvals, for possible revision and resubmittal, and for placing orders and securing delivery.
- B. In scheduling, allow sufficient time for the Engineer's review following the receipt of the submittal.

3.03 Reviewed Shop Drawings

- A. Engineer Review
 - 1. Allow a minimum of 30 days for the Engineer's initial processing of each submittal requiring review and response, except allow longer periods where processing must be delayed for coordination with subsequent submittals. The Engineer will advise the Contractor promptly when it is determined that a submittal being processed must be delayed for coordination. Allow a minimum of two weeks for reprocessing each submittal. Advise the Engineer on each submittal as to whether processing time is critical to progress of the Work, and therefore the Work would be expedited if processing time could be foreshortened.
 - 2. Acceptable submittals will be marked "No Exceptions Taken". A minimum of three copies will be retained by the Engineer for Engineer's and the Owner's use and the remaining copies will be returned to the Contractor.
 - 3. Submittals requiring minor corrections before the product is acceptable will be marked "Make Corrections Noted". The Contractor may order, fabricate and ship the items included in the submittals, provided the indicated corrections are made. Drawings must be resubmitted for review and marked "No Exceptions Taken" prior to installation or use of products.
 - 4. Submittals marked "Amend and Resubmit" must be revised to reflect required changes and the initial review procedure repeated.
 - 5. The "Rejected - See Remarks" notation is used to indicate products which are not acceptable. Upon return of a submittal so marked, the Contractor shall repeat the initial review procedure utilizing acceptable products.
 - 6. Only two copies of items marked "Amend and Resubmit" and "Rejected - See Remarks" will be reviewed and marked. One copy will be retained by the Engineer and the other copy with all remaining unmarked copies will be returned to the Contractor for resubmittal.

- B. No work or products shall be installed without a drawing or submittal bearing the "No Exceptions Taken" notation. The Contractor shall maintain at the job site a complete set of shop drawings bearing the Engineer's stamp.
- C. Substitutions: In the event the Contractor obtains the Engineer's approval for the use of products other than those which are listed first in the Contract Documents, the Contractor shall, at the Contractor's own expense and using methods approved by the Engineer, make any changes to structures, piping and electrical work that may be necessary to accommodate these products.
- D. Use of the "No Exceptions Taken" notation on shop drawings or other submittals is general and shall not relieve the Contractor of the responsibility of furnishing products of the proper dimension, size, quality, quantity, materials and all performance characteristics, to efficiently perform the requirements and intent of the Contract Documents. The Engineer's review shall not relieve the Contractor of responsibility for errors of any kind on the shop drawings. Review is intended only to assure conformance with the design concept of the Project and compliance with the information given in the Contract Documents. The Contractor is responsible for dimensions to be confirmed and correlated at the job site. The Contractor is also responsible for information that pertains solely to the fabrication processes or to the technique of construction and for the coordination of the work of all trades.

3.04 Resubmission Requirements

- A. Shop Drawings
 - 1. Revise initial drawings as required and resubmit as specified for initial submittal, with the resubmittal number shown.
 - 2. Indicate on drawings all changes which have been made other than those requested by the Engineer.
- B. Project Data and Samples: Resubmit new data and samples as specified for initial submittal, with the resubmittal number shown.

END OF SECTION

Part 1 General

1.01 Scope

- A. Clearing and grubbing includes, but is not limited to, removing from the Project site, trees, stumps, roots, brush, structures, abandoned utilities, trash, debris and all other materials found on or near the surface of the ground in the construction area and understood by generally accepted engineering practice not to be suitable for construction of the type contemplated. Precautionary measures that prevent damage to existing features to remain is part of the Work.
- B. Clearing and grubbing operations shall be coordinated with temporary and permanent erosion and sedimentation control procedures.

1.02 Quality Assurance

- A. The Contractor shall comply with applicable codes, ordinances, rules, regulations and laws of local, municipal, state or federal authorities having jurisdiction over the Project. All required permits of a temporary nature shall be obtained for construction operations by the Contractor.
- B. Open burning, if allowed, shall first be permitted by the local authority having jurisdiction. The Contractor shall notify the local fire department and abide by fire department restrictions.

1.03 Job Conditions

Location of the Work: The area to be cleared and grubbed is shown schematically on the Drawings or specified below. It includes all areas designated for construction.

Part 2 Products

2.01 Equipment

The Contractor shall furnish equipment of the type normally used in clearing and grubbing operations including, but not limited to, tractors, trucks, loaders, root rakes and burning equipment.

Part 3 Execution

3.01 Scheduling of Clearing

- A. The Contractor shall clear at each construction site only that length of the right-of-way, permanent or construction easement which would be the equivalent of one month's pipe laying. This length shall be determined from the Contractor's Progress Schedule.

- B. The Engineer may permit clearing for additional lengths of the pipe line provided that temporary erosion and sedimentation controls are in place and a satisfactory stand of temporary grass is established. Should a satisfactory stand of grass not be possible, no additional clearing shall be permitted beyond that specified above.
- C. A satisfactory stand of grass shall have no bare spots larger than one square yard. Bare spots shall be scattered and the bare area shall not comprise more than one percent of any given area.

3.02 Clearing and Grubbing

- A. Clear and grub the permanent easement on each side of the pipeline before excavating. Remove all trees, growth, debris, stumps and other objectionable matter. Clear the construction easement or road right-of-way only if necessary.
- B. Grubbing shall consist of completely removing roots, stumps, trash and other debris from all graded areas so that topsoil is free of roots and debris. Topsoil is to be left sufficiently clean so that further picking and raking will not be required.
- C. All stumps, roots, foundations and planking embedded in the ground shall be removed and disposed of. Piling and butts of utility poles shall be removed to a minimum depth of two feet below the limits of excavation for structures, trenches and roadways or two feet below finish grade, whichever is lower.
- D. Landscaping features shall include, but are not necessarily limited to, fences, cultivated trees, cultivated shrubbery, property corners, man-made improvements, subdivision and other signs within the right-of-way and easement. The Contractor shall take extreme care in moving landscape features and promptly re-establishing these features.
- E. Surface rocks and boulders shall be grubbed from the soil and removed from the site if not suitable as rip rap.
- F. Where the tree limbs interfere with utility wires, or where the trees to be felled are in close proximity to utility wires, the tree shall be taken down in sections to eliminate the possibility of damage to the utility.
- G. Any work pertaining to utility poles shall comply with the requirements of the appropriate utility.
- H. All fences adjoining any excavation or embankment that, in the Contractor's opinion, may be damaged or buried, shall be carefully removed, stored and replaced. Any fencing that, in the Engineer's opinion, is significantly damaged shall be replaced with new fence material.

- I. The Contractor shall exercise special precautions for the protection and preservation of trees, cultivated shrubs, sod, fences, etc. situated within the limits of the construction area but not directly within excavation and/or fill limits. The Contractor shall be held liable for any damage the Contractor's operations have inflicted on such property.
- J. The Contractor shall be responsible for all damages to existing improvements resulting from Contractor's operations.

3.03 Disposal of Debris

- A. The debris resulting from the clearing and grubbing operation shall be hauled to a disposal site secured by the Contractor and shall be disposed of in accordance with all requirements of federal, state, county and municipal regulations. No debris of any kind shall be deposited in any stream or body of water, or in any street or alley. No debris shall be deposited upon any private property except with written consent of the property owner. In no case shall any material or debris be left on the Project, shoved onto abutting private properties or buried on the Project.
- B. When approved in writing by the Engineer and when authorized by the proper authorities, the Contractor may dispose of such debris by burning on the Project site provided all requirements set forth by the governing authorities are met. The authorization to burn shall not relieve the Contractor in any way from damages which may result from Contractor's operations. On easements through private property, the Contractor shall not burn on the site unless written permission is also secured from the property owner, in addition to authorization from the proper authorities.

END OF SECTION

Part 1 General

1.01 Scope

A. Submittals and Permits

1. If required, within 15 days after the date of the Notice to Proceed, the Contractor shall submit description, drawings and schedule for proposed temporary and permanent erosion and sedimentation controls to the Engineer. The description and drawings shall be consistent with the Best Management Practices of the Erosion and Sediment Control Practices for Developing Areas, as published by the Erosion and Sediment Control Division of the South Carolina Land Resources Conservation Commission. All fines imposed for improper erosion and sedimentation control shall be paid by the Contractor. The Contractor shall acquire Land Disturbance Permits from the appropriate authority and shall pay any fees for said permits. This includes filing a Land Disturbance Permit with the South Carolina Department of Health and Environmental Control (SCDHEC). Once the Land Disturbance Permit is obtained, the Contractor shall obtain a Land Use permit from the Anderson or Pickens County Development Standards Department. All fines imposed for improper erosion and sedimentation control shall be paid by the Contractor.
2. The Engineer will provide a reproducible drawing of plan sheets to the Contractor for Contractor's use. The reproducible will not bear the Engineer's seal or logo and is provided only for the Contractor's convenience in preparing the plan for temporary erosion and sedimentation control.
3. Description and working drawings shall indicate controls which will ensure that storm water and drainage from the disturbed jobsite areas, which will be denuded, stripped or modified of its naturally existing or artificially established stabilization or protection against erosion, shall pass through some type of filter system before being discharged. These areas shall be kept sufficiently moist to control dust.
4. Submit a written plan for both temporary and permanent grassing. The plan shall include selection of species, dates and rates of application for seeding, fertilizer and mulching.

B. Basic Principles

1. Conduct the earthwork and excavation activities in such a manner to fit the topography, soil type and condition.
2. Minimize the disturbed area and the duration of exposure to erosion elements.
3. Stabilize disturbed areas immediately.
4. Safely convey run-off from the site to an outlet such that erosion will not be increased off site.

5. Retain sediment on site that was generated on site.
6. Minimize encroachment upon watercourses.

C. Implementation

1. The erosion and sedimentation control measures shown on the Drawings are minimal requirements. The Contractor's methods of operation may dictate additional erosion and sedimentation control measures not shown on the Drawings which shall be the Contractor's responsibility to determine and install said measures. The Contractor's failure to stabilize disturbed areas immediately following intermediate or final grading may dictate additional erosion and sedimentation control measures not shown on the Drawings which shall be the Contractor's responsibility to determine and install said measures.
2. The Contractor shall notify the Engineer of any changes and/or additions to the erosion and sedimentation control plan necessary to accommodate the Contractor's methods of operation. No additional payment shall be made for erosion and sedimentation control measures made necessary by the Contractor's methods of operation.
3. The Contractor shall be solely responsible for control of erosion within the Project site and prevention of sedimentation of any adjacent waterways.
4. The Contractor shall install controls which will ensure that stormwater and drainage from the disturbed area of the Project site shall pass through some type of filter system before being discharged. The filter system must meet the requirements of South Carolina Department of Health and Environmental Control.

D. Temporary Erosion and Sedimentation Control: In general, temporary erosion and sedimentation control procedures shall be directed toward:

1. Preventing soil erosion at the source.
2. Preventing silt and sediment from entering any waterway if soil erosion cannot be prevented.
3. Preventing silt and sediment from migrating downstream in the event it cannot be prevented from entering the waterway.

E. Permanent Erosion Control: Permanent erosion control measures shall be implemented to prevent sedimentation of the waterways and to prevent erosion of the Project site.

1.02 Quality Assurance

- A. General: Perform all work under this Section in accordance with all pertinent rules and regulations including, but not necessarily limited to, those stated herein and these Specifications.
- B. Conflicts: Where provisions of pertinent rules and regulations conflict with these Specifications, the more stringent provisions shall govern.

Part 2 Products

2.01 Temporary Erosion and Sedimentation Control Materials

- A. Silt Fence
 - 1. Silt fence shall be polymer type netting with a built-in cord running throughout the top edge of the fabric. Posts shall be either steel or pressure treated fir, southern pine or hemlock and shall be spaced not more than six feet on center. Silt fence shall be provided with netting to provide reinforcing when necessary. Silt fence shall have an Equivalent Opening Size (EOS) of 40 to 100. Silt fence fabric shall have a maximum permeability of 40 gallons per minute per square foot.
 - 2. Silt fence fabric shall be equal to Mirafi 100X, Amoco 1380 or Exxon GTF-100 Series.
- B. Hay bales shall be clean, seedfree cereal hay type.
- C. Netting shall be 1/2-inch, galvanized steel, chicken wire mesh.
- D. Filter stone shall be coarse aggregate conforming to South Carolina Department of Highways and Public Transportation, Aggregate Number CR-14.
- E. Concrete block shall be hollow, non-load-bearing type.
- F. Plywood shall be 3/4-inch thick exterior type.

2.02 Rip Rap

- A. Use only one method throughout the job.
- B. Stone Rip Rap: Use sound, tough, durable stones resistant to the action of air and water. Slabby or shaley pieces will not be acceptable. Unless shown or specified otherwise, stone rip rap shall be Type 1 rip rap.
 - 1. Type 1 Rip Rap: Stone pieces shall range in weight from a minimum of 25 pounds to a maximum of 250 pounds. At least 60 percent of the stone pieces shall weigh more than 150 pounds. Rip rap shall conform to South Carolina

Department of Highways and Public Transportation Standard Specifications 804.04.

2. Type 2 Rip Rap: Stone shall vary in size with no pieces weighing more than 150 pounds. At least 20 percent of the stone pieces, excluding spalls, shall weigh more than 60 pounds and no more than 20 percent of the stone pieces, excluding spalls, shall weigh less than 25 pounds. Rip rap size shall conform to South Carolina Department of Highways and Public Transportation Standard Specifications 804.03.

C. Sand-Cement Bag Rip Rap

1. The bags shall be of cotton, burlap or fiber reinforced paper capable of containing the sand-cement mixture without leakage during handling and placing. Bags previously used for sugar or any other material which will adversely affect the sand-cement mixture shall not be used. Capacity shall be not less than 0.75 cubic foot, nor more than two cubic feet.
2. Sand and Portland cement shall be mixed at the maximum ratio of 5:1 by weight and shall obtain a minimum compressive strength of 500 psi in seven days. For sand-cement bag rip rap, the amount of water used shall be just enough to make up the optimum moisture content of the aggregate and cement, as determined by AASHTO T 134. When sand-cement rip rap is to be pre-bagged, the sand-cement shall be mixed dry, and after placing each course, the bags shall be wet until sufficient moisture is present for proper cement hydration.

2.03 Filter Fabric

- A. The filter fabric for use under rip rap shall be a monofilament, polypropylene woven fabric meeting the specifications as established by Task Force 25 for the Federal Highway Administration. The filter fabric shall have an equivalent opening size (EOS) of 70.
- B. Filter fabric under rip rap shall be equal to Mirafi, Amoco or Exxon.

2.04 Concrete

- A. Concrete shall have a compressive strength of not less than 3,000 psi, with not less than 5.5 bags of cement per cubic yard and a slump between 3 and 5-inches. Ready-mixed concrete shall be mixed and transported in accordance with ASTM C 94. Reinforcing steel shall conform to the requirements of ASTM A 615, Grade 60.
- B. Provide a concrete mix design for job mixed concrete for the Engineer's approval.

Part 3 Execution

3.01 General

Standards: Provide all materials and promptly take all actions necessary to achieve effective erosion and sedimentation control in accordance with the Best Management Practices of the Erosion and Sediment Control Practices for Developing Areas, local enforcing agency guidelines and these Specifications.

3.02 Temporary Erosion and Sedimentation Control

- A. Temporary erosion and sedimentation control procedures should be initially directed toward preventing silt and sediment from entering the creeks. The preferred method is to provide an undisturbed natural buffer, extending a minimal 25 feet from the top of the bank, to filter the run-off. Should this buffer prove infeasible due to construction activities being too close to the creek, or if the amount of sediment overwhelms the buffer, the Contractor shall place silt fences to filter the run-off and, if necessary, place permanent rip rap to stabilize the creek banks. When excavation activities disturb the previously stated preventative measures, or if they are not maintained, or whenever the construction activities cross the creeks, check dams shall be installed downstream and within 200 feet of the affected area.
- B. Silt dams, silt fences, traps, barriers, check dams, appurtenances and other temporary measures and devices shall be installed as indicated on the approved plans and working drawings, shall be maintained until no longer needed, and shall then be removed. Deteriorated hay bales and dislodged filter stone shall be replaced with new materials. Detention ponds, if constructed, shall be maintained in a condition ensuring that unfiltered water will not leave the pond.
- C. Where permanent grassing is not appropriate, and where the Contractor's temporary erosion and sedimentation control practices are inadequate, the Engineer may direct the Contractor to provide temporary vegetative cover with fast growing seedlings. Such temporary vegetative cover shall be provided by the Contractor in compliance with the Best Management Practices of the Erosion and Sediment Control Practices for Developing Areas, specifically in the selection of species, planting dates and application rates for seedlings, fertilizer and mulching with the exception that kudzu shall not be permitted.
- D. All erosion and sedimentation control devices, including check dams, shall be inspected by the Contractor at least weekly and after each rainfall occurrence and cleaned out and repaired by the Contractor as necessary.
- E. Temporary erosion and sedimentation control devices shall be installed and maintained from the initial land disturbance activity until the satisfactory completion and establishment of permanent erosion control measures. At that time, temporary devices shall be removed.

3.03 Permanent Erosion Control

- A. Permanent erosion control shall include:
 - 1. Restoring the work site to its original contours, unless shown otherwise on the Drawings or directed by the Engineer.
 - 2. Permanent vegetative cover shall be performed in accordance with Article 3.04 of this Section.
 - 3. Permanent stabilization of steep slopes and creeks shall be performed in accordance with Article 3.05 of this Section.
- B. Permanent erosion control measures shall be implemented as soon as practical after the completion of pipe installation or land disturbance for each segment of the Project. In no event shall implementation be postponed when no further construction activities will impact that portion or segment of the Project. Partial payment requests may be withheld for those portions of the Project not complying with this requirement.

3.04 Grassing

- A. General
 - 1. All references to grassing, unless noted otherwise, shall relate to establishing permanent vegetative cover as specified herein for seeding, fertilizing, mulching, etc.
 - 2. When final grade has been established, all bare soil, unless otherwise required by the Contract Documents, shall be seeded, fertilized and mulched in an effort to restore to a protected condition. Critical areas shall be sodded as approved or directed by the Engineer.
 - 3. Specified permanent grassing shall be performed at the first appropriate season following establishment of final grading in each section of the site.
 - 4. Permanent grassing shall be of a perennial species.
- B. Replant grass removed or damaged in residential areas using the same variety of grass and at the first appropriate season. Where sod is removed or damaged, replant such areas using sod of the same species of grass at the first appropriate season. Outside of residential or landscaped areas, grass the entire area disturbed by the work on completion of work in any area. In all areas, promptly establish successful stands of grass.
- C. Grassing activities shall comply with the Best Management Practices of the Erosion and Sediment Control Practices for Developing Areas, specifically for the selection of species; with the exception that kudzu shall not be permitted, planting dates and application rates for seeding, fertilizer and mulching. Where permanent vegetative cover (grassing) cannot be immediately established (due to season or other

circumstances) the Contractor shall provide temporary vegetative cover. The Contractor must return to the site (at the appropriate season) to install permanent vegetation in areas that have received temporary vegetative cover.

3.05 Rip Rap

- A. Unless shown otherwise on the Drawings, rip rap shall be placed where ordered by the Engineer, at all points where banks of streams or drainage ditches are disturbed by excavation, or at all points where natural vegetation is removed from banks of the streams or drainage ditches. Carefully compact backfill and place rip rap to prevent subsequent settlement and erosion. This requirement applies equally to construction along side a stream or drainage ditch as well as crossing a stream or drainage ditch.
- B. When trenching across a creek, place rip rap a distance of 10 feet upstream and 10 feet downstream from the top of the trench excavation. Place rip rap across creek bottom, across creek banks and extend rip rap placement five feet beyond the top of each creek bank.
- C. Preparation of Foundations: The ground surface upon which the rip rap is to be placed shall be brought in reasonably close conformity to the correct lines and grades before placement is commenced. Where filling of depressions is required, the new material shall be compacted with hand or mechanical tampers. Unless at creek banks or otherwise shown or specified, rip rap shall begin in a toe ditch constructed in original ground around the toe of the fill or the cut slope. The toe ditch shall be two feet deep in original ground and the side next to the fill or cut shall have that same slope. After the rip rap is placed, the toe ditch shall be backfilled and the excess dirt spread neatly.
- D. Placement of Filter Fabric: The surface to receive fabric shall be prepared to a relatively smooth condition free from obstructions, depressions and debris. The fabric shall be placed with the long dimension running up the slope and shall be placed to provide a minimum number of overlaps. The strips shall be placed to provide a minimum width of one foot of overlap for each joint. The filter fabric shall be anchored in place with securing pins of the type recommended by the fabric manufacturer. Pins shall be placed on or within 3-inches of the centerline of the overlap. The fabric shall be placed so that the upstream strip overlaps the downstream strip. The fabric shall be placed loosely so as to give and therefore avoid stretching and tearing during placement of the stones. The stones shall be dropped no more than three feet during construction. The fabric shall be protected at all times during construction from clogging due to clay, silts, chemicals or other contaminants. Any contaminated fabric or any fabric damaged during its installation or during placement of rip rap shall be removed and replaced with uncontaminated and undamaged fabric at no expense to the Owner.
- E. Placement of Rip Rap: The rip rap shall be placed on a 6-inch layer of soil, crushed stone or sand overlaying the filter fabric. This 6-inch layer shall be placed to maximize the contact between the soil beneath the filter fabric and the filter fabric. Rip rap shall be placed with its top elevation conforming with the finished grade or the natural slope of the stream bank and stream bottom.

1. Stone Rip Rap: Stone rip rap shall be dumped into place to form a uniform surface and to the thickness specified on the Drawings. The thickness tolerance for the course shall be -6-inches and +12-inches. If the Drawings or the Bid do not specify a thickness, the course shall be placed to a thickness of not less than 18-inches.
2. Sand-Cement Bag Rip Rap: The bags shall be uniformly filled to the maximum capacity which will permit satisfactory tying. The bagged rip rap shall be placed by hand with the tied ends facing the same direction, with close, broken joints. When directed by the Engineer or required by the Drawings, header courses shall be placed. After placing, the bags shall be rammed or packed against one another to produce the required thickness and form a consolidated mass. The top of each bag shall not vary more than 3-inches above or below the required plane.

END OF SECTION

Part 1 General

1.01 Scope

- A. The work under this Section consists of furnishing all labor, equipment and materials and performing all operations in connection with the trench excavation and backfill required to install the pipelines shown on the Drawings and as specified.
- B. Excavation shall include the removal of any trees, stumps, brush, debris or other obstacles which remain after the clearing and grubbing operations, which may obstruct the work, and the excavation and removal of all earth, rock or other materials to the extent necessary to install the pipe and appurtenances in conformance with the lines and grades shown on the Drawings and as specified.
- C. Backfill shall include the refilling and compaction of the fill in the trenches and excavations up to the surrounding ground surface or road grade at crossing.
- D. The pipe zone area of the trench is divided into five specific areas and is shown on the typical details:
 - 1. Foundation: The area beneath the bedding, sometimes also referenced to as trench stabilization.
 - 2. Bedding: The area above the trench bottom (or foundation) and below the bottom of the barrel of the pipe.
 - 3. Haunching: The area above the bottom of the barrel of the pipe up to a specified height above the bottom of the barrel of the pipe.
 - 4. Initial Backfill: The area above the haunching material and below a plane 18-inches above the top of the barrel of the pipe.
 - 5. Final Backfill: The area above a plane 18-inches above the top of the barrel of the pipe.
- E. The choice of method, means, techniques and equipment rests with the Contractor. The Contractor shall select the method and equipment for trench excavation and backfill depending upon the type of material to be excavated and backfilled, the depth of excavation, the amount of space available for operation of equipment, storage of excavated material, proximity of man-made improvements to be protected, available easement or right-of-way and prevailing practice in the area.

1.02 Quality Assurance

- A. Density: All references to “maximum dry density” shall mean the maximum dry density defined by the “Maximum Density-Optimum Moisture Test”, ASTM D 698. Determination of the density of foundation, bedding, haunching, or backfill materials in place shall meet with the requirements of ASTM D 1556, “Density of Soil In Place by the Sand Cone Method”, ASTM D 2937, “Density of Soil In Place by the Drive-Cylinder Method” or ASTM D 2922, “Density of Soil and Soil-Aggregate In Place by Nuclear Methods (Shallow Depth)”.
- B. Sources and Evaluation Testing: Testing of materials to certify conformance with the Specification requirements shall be performed by an independent testing laboratory at no cost to the Owner. The Contractor's testing laboratory shall perform tests, at no cost to the Owner, upon change of source and at sufficient intervals during the work to certify conformance of all select material furnished for use on this Project.

1.03 Safety

Perform all trench excavation and backfilling activities in accordance with the Occupational Safety and Health Act of 1970 (PL 91-596), as amended. The Contractor shall pay particular attention to the Safety and Health Regulations Part 1926, Subpart P “Excavation, Trenching & Shoring” as described in OSHA 2226.

Part 2 Products

2.01 Trench Foundation Materials

Where called for by the Engineer, crushed stone shall be utilized for trench foundation (trench stabilization) and shall meet the requirements of the South Carolina DOT Specification 406.08 with the exception that slag or crushed slag shall not be used. Stone size shall be between No. 57 and No. CR 14, inclusive.

2.02 Bedding and Haunching Materials

- A. Unless specified otherwise, bedding and haunching materials shall be as specified below.
- B. Earth materials utilized for bedding and haunching shall be suitable materials selected from materials excavated from the trench. Suitable materials shall be clean and free of rock larger than 2-inches at its largest dimension, organics, cinders, stumps, limbs, frozen earth or mud, man-made wastes and other unsuitable materials. Should the material excavated from the trench be saturated, the saturated material may be used as earth material, provided it is allowed to dry properly and it is capable of meeting the specified compaction requirements. When necessary, earth bedding and haunching materials shall be moistened to facilitate compaction by tamping. If materials excavated from the trench are not suitable for use as bedding or haunching material, provide select material conforming to the requirements of this Section at no additional cost to the Owner. Bell holes shall be utilized to reduce axial deflection.

- C. Where called for by the Engineer, crushed stone shall be utilized for bedding and haunching, and shall meet the requirements of the South Carolina DOT Specification 406.08 with the exception that slag or crushed slag shall not be used. Stone size shall be No. 57.

2.03 Initial Backfill

- A. Initial backfill material shall be clean earth materials or crushed stone as specified for bedding and haunching materials.
- B. Earth materials utilized for initial backfill shall be suitable materials selected from materials excavated from the trench. Suitable materials shall be clean and free of rock larger than 2-inches at its largest dimension, organics, cinders, stumps, limbs, frozen earth or mud, man-made wastes and other unsuitable materials. Should the material excavated from the trench be saturated, the saturated material may be used as earth material, provided it is allowed to dry properly and it is capable of meeting the specified compaction requirements. When necessary, initial backfill materials shall be moistened to facilitate compaction by tamping. If materials excavated from the trench are not suitable for use as initial backfill material, provide select material conforming to the requirements of this Section.

2.04 Final Backfill

Final backfill material shall be general excavated earth materials, shall not contain rock larger than 2-inches at its greatest diameter, cinders, stumps, limbs, man-made wastes and other unsuitable materials. If materials excavated from the trench are not suitable for use as final backfill material, provide select material conforming to the requirements of this Section.

2.05 Select Backfill

Select backfill shall be materials which meet the requirements as specified for bedding, haunching, initial backfill or final backfill materials, including compaction requirements.

2.06 Concrete

Concrete for bedding, haunching, initial backfill or encasement shall have a compressive strength of not less than 3,000 psi, with not less than 5.5 bags of cement per cubic yard and a slump between 3 and 5-inches. Ready-mixed concrete shall be mixed and transported in accordance with ASTM C 94. Reinforcing steel shall conform to the requirements of ASTM A 615, Grade 60.

Part 3 Execution

3.01 Trench Excavation

- A. Where directed by the Engineer, topsoil and grass shall be stripped a minimum of 6-inches over the trench excavation site and stockpiled separately for replacement over the finished grading areas.
- B. Trenches shall be excavated to the lines and grades shown on the Drawings with the centerlines of the trenches on the centerlines of the pipes and to the dimensions which provide the proper support and protection of the pipe and other structures and accessories.
- C. Width
 - 1. The sides of all trenches shall be vertical to a minimum of one foot above the top of the pipe. Unless otherwise indicated on the Drawings, the maximum trench width shall be equal to the sum of the outside diameter of the pipe plus two feet. The minimum trench width shall be that which allows the proper consolidation of the haunching and initial backfill material.
 - 2. Excavate the top portion of the trench to any width within the construction easement or right-of-way which will not cause unnecessary damage to adjoining structures, roadways, pavement, utilities, trees or private property. Where necessary to accomplish this, provide sheeting and shoring.
 - 3. Where rock is encountered in trenches, excavate to remove boulders and stones to provide a minimum of 9-inches clearance between the rock and any part of the pipe barrel or manhole.
 - 4. Wherever the prescribed maximum trench width is exceeded, the Contractor shall use the next higher class (load factor) of bedding and haunching for the full trench width as actually cut, at no additional cost to the Owner. The excessive trench width may be due to unstable trench walls, inadequate or improperly placed bracing and sheeting which caused sloughing, accidental over-excavation, intentional over-excavation necessitated by the size of the Contractor's tamping and compaction equipment, intentional over-excavation due to the size of the Contractor's excavation equipment, or other reasons beyond the control of the Engineer or Owner.
- D. Depth
 - 1. The trenches shall be excavated to the required depth or elevation which allow for the placement of the pipe and bedding to the thickness shown on the Drawings.
 - 2. Water Mains
 - a. Excavate trenches to provide a minimum cover of three feet. Within the

right-of-way of highways, streets or roadways, also excavate to place the top of the pipe a minimum of three feet below the nearest pavement edge.

- b. Increase the depth of cover where specifically shown on the Drawings and where necessary to avoid interference with underground utilities and obstructions. Maximum cover is 60-inches unless otherwise directed by the Engineer.
3. Where rock is encountered in trenches, excavate to the minimum depth which will provide clearance below the pipe barrel of 8-inches for pipe 21-inches in diameter and smaller and 12-inches for larger pipe, valves and manholes. Remove boulders and stones to provide a minimum of 6-inches clearance between the rock and any part of the pipe, manhole or accessory.

E. Excavated Materials

1. Excavated materials shall be placed adjacent to the work to be used for backfilling as required. In specific areas as directed by the Engineer, topsoil shall be carefully separated and lastly placed in its original location.
2. Excavated material shall be placed sufficiently back from the edge of the excavation to prevent caving of the trench wall, to permit safe access along the trench and not cause any drainage problems. Excavated material shall be placed so as not to damage existing landscape features or man-made improvements.

3.02 Sheeting, Bracing and Shoring

A. Sheeting, bracing and shoring shall be performed in the following instances:

1. Where sloping of the trench walls do not adequately protect persons within the trench from slides or cave-ins.
2. In caving ground.
3. In wet, saturated, flowing or otherwise unstable materials. The sides of all trenches and excavations shall be adequately sheeted, braced and shored.
4. Where necessary to prevent damage to adjoining buildings, structures, roadways, pavement, utilities, trees or private properties which are required to remain.
5. Where necessary to maintain the top of the trench within the available construction easement or right-of-way.
6. Where shown on the Drawings, sheeting shall be steel sheeting.

B. In all cases, excavation protection shall strictly conform to the requirements of the Occupational Safety and Health Act of 1970, as amended.

- C. Timber: Timber for shoring, sheeting, or bracing shall be sound and free of large or loose knots and in good, serviceable condition. Size and spacing shall be in accordance with OSHA regulations.
- D. Steel Sheeting and Sheet Piling: Steel sheet piling shall be the continuous interlock type. The weight, depth and section modulus of the sheet piling shall be sufficient to restrain the loads of earth pressure and surcharge from existing foundations and live loads. Procedure for installation and bracing shall be so scheduled and coordinated with the removal of the earth that the ground under existing structures shall be protected against lateral movement at all times. The Contractor shall provide closure and sealing between sheet piling and existing facilities. Sheet piling within three feet of an existing structure or pipeline shall remain in place, unless otherwise directed by the Engineer.
- E. Trench Shield: A trench shield or box may be used to support the trench walls. The use of a trench shield does not necessarily preclude the additional use of bracing and sheeting. When trench shields are used, care must be taken to avoid disturbing the alignment and grade of the pipe or disrupting the haunching of the pipe as the shield is moved. When the bottom of the trench shield extends below the top of the pipe, the trench shield will be raised in 6-inch increments with specified backfilling occurring simultaneously. At no time shall the trench shield be "dragged" with the bottom of the shield extending below the top of the pipe.
- F. Remove bracing and sheeting in units when backfill reaches the point necessary to protect the pipe and adjacent property. Leave sheeting in place when in the opinion of the Engineer it cannot be safely removed. Cut off any sheeting left in place at least two feet below the surface.

3.03 Rock Excavation

- A. Definition of Rock: Any material which cannot be excavated with conventional excavating equipment, and is removed by drilling and blasting, and occupies an original volume of at least one-half cubic yard.
- B. Blasting: Provide licensed, experienced workmen to perform blasting. Conduct blasting operations in accordance with all existing ordinances and regulations. Protect all buildings and structures from the effects of the blast. Repair any resulting damage. If the Contractor repeatedly uses excessive blasting charges or blasts in an unsafe or improper manner, the Engineer may direct the Contractor to employ an independent blasting consultant to supervise the preparation for each blast and approve the quantity of each charge.
- C. Removal of Rock: Dispose of rock off site that is surplus or not suitable for use as rip rap or backfill.
- D. The Contractor shall notify the Engineer prior to any blasting. Additionally, the Contractor shall notify the Engineer before any charge is set.

- E. Following review by the Engineer regarding the proximity of permanent buildings and structures to the blasting site, the Engineer may direct the Contractor to employ an independent, qualified specialty sub-contractor, approved by the Engineer, to monitor the blasting by use of seismograph, identify the areas where light charges must be used, conduct pre-blast and post-blast inspections of structures, including photographs or videos, and maintain a detailed written log.

3.04 Dewatering Excavations

- A. Dewater excavation continuously to maintain a water level two feet below the bottom of the trench.
- B. Control drainage in the vicinity of excavation so the ground surface is properly pitched to prevent water running into the excavation.
- C. There shall be sufficient pumping equipment, in good working order, available at all times, to remove any water that accumulates in excavations. Where the pipe line crosses natural drainage channels, the work shall be conducted in such a manner that unnecessary damage or delays in the prosecution of the work will be prevented. Provision shall be made for the satisfactory disposal of surface water to prevent damage to public or private property.
- D. In all cases, accumulated water in the trench shall be removed before placing bedding or haunching, laying pipe, placing concrete or backfilling.
- E. Where dewatering is performed by pumping the water from a sump, crushed stone shall be used as the medium for conducting the water to the sump. Sump depth shall be at least two feet below the bottom of the trench, Pumping equipment shall be of sufficient quantity and/or capacity to maintain the water level in the sump two feet below the bottom of the trench. Pumps shall be a type such that intermittent flows can be discharged. A standby pump shall be required in the event the operating pump or pumps clog or otherwise stop operation.
- F. Dewater by use of a well point system when pumping from sumps does not lower the water level two feet below the trench bottom. Where soil conditions dictate, the Contractor shall construct well points cased in sand wicks. The casing, 6 to 10-inches in diameter, shall be jetted into the ground, followed by the installation of the well point, filling casing with sand and withdrawing the casing.

3.05 Trench Foundation and Stabilization

- A. The bottom of the trench shall provide a foundation to support the pipe and its specified bedding. The trench bottom shall be graded to support the pipe and bedding uniformly throughout its length and width.
- B. If, after dewatering as specified above, the trench bottom is spongy, or if the trench bottom does not provide firm, stable footing and the material at the bottom of the trench will still not adequately support the pipe, the trench will be determined to be unsuitable and the Engineer may then authorize payment for trench stabilization.

- C. Should the undisturbed material encountered at the trench bottom constitute, in the opinion of the Engineer, an unstable foundation for the pipe, the Contractor shall be required to remove such unstable material and fill the trench to the proper subgrade with crushed stone.
- D. Where trench stabilization is provided, the trench stabilization material shall be compacted to at least 90 percent of the maximum dry density, unless shown or specified otherwise.

3.06 Bedding and Haunching

- A. Bedding material shall be placed to provide uniform support along the bottom of the pipe and to place and maintain the pipe at the proper elevation. The initial layer of bedding placed to receive the pipe shall be brought to the grade and dimensions indicated on the Drawings, and the pipe shall be placed thereon and brought to grade by tamping the bedding material or by removal of the slight excess amount of the bedding material under the pipe. Adjustment to grade line shall be made by scraping away or filling with bedding material. Wedging or blocking up of pipe shall not be permitted. Applying pressure to the top of the pipe, such as with a backhoe bucket, to lower the pipe to the proper elevation or grade shall not be permitted. Each pipe section shall have a uniform bearing on the bedding for the length of the pipe, except immediately at the joint. All bedding shall extend the full width of the trench bottom. Prior to placement of bedding material, the trench bottom shall be free of any water, loose rocks, boulders or large dirt clods.
- B. At each joint, excavate bell holes of ample depth and width to permit the joint to be assembled properly and to relieve the pipe bell of any load.
- C. After the pipe section is properly placed, add the haunching material to the specified depth. The haunching material shall be shovel sliced, tamped, vigorously chinked or otherwise consolidated to provide uniform support for the pipe barrel and to fill completely the voids under the pipe, including the bell hole. Prior to placement of the haunching material, the bedding shall be clean and free of any water, loose rocks, boulders or dirt clods.
- D. Manholes or Vaults: Unless specified otherwise, excavate to a minimum of 12-inches below the planned elevation of the base of the manhole/vault. Place and compact crushed stone bedding material to the required grade before constructing the manhole or vault.

F. Water Mains

1. Ductile Iron Pipe

- a. Unless otherwise shown on the Drawings or specified, utilize earth materials for bedding and haunching. Type 2, 3, 4 and 5 bedding shall be as detailed on the Drawings.
- b. Unless specified or shown otherwise, bedding shall meet the requirements for Type 2 Pipe Bedding. Unless specified or shown otherwise for restrained joint pipe and fittings, bedding shall meet the requirements for Type 3 Pipe Bedding.
- c. Where the depth of cover over the piping exceeds 12 feet, the pipe bedding shall meet the requirements of Type 4 Pipe Bedding. Where the depth of cover over the piping exceeds 18 feet, the pipe bedding shall meet the requirements of Type 5 Pipe Bedding.
- d. Type 4 or Type 5 Pipe Bedding called for on the Drawings, specified or ordered by the Engineer, shall meet requirements for Type 4 or Type 5 Pipe Bedding, utilizing crushed stone bedding and haunching material.

2. Polyvinyl Chloride Pipe

- a. Unless shown otherwise on the Drawings, utilize earth materials for bedding and haunching.
- b. Unless shown otherwise on the Drawings, bedding and haunching shall meet the requirements for Type 2 Pipe Bedding, as detailed on the Drawings.

G. Excessive Width and Depth

1. Water Mains: If the trench is excavated to excess width, provide the next higher type or class of pipe bedding, but a minimum of Type 4, as detailed on the Drawings.
2. If the trench is excavated to excessive depth, provide crushed stone to place the bedding at the proper elevation or grade.

H. Compaction: Bedding and haunching materials under pipe, manholes and accessories shall be compacted to a minimum of 90 percent of the maximum dry density, unless shown or specified otherwise.

I. Stones, other than crushed bedding, shall not come into contact with the pipe and shall not be within six (6) inches of the pipe.

3.07 Initial Backfill

- A. Initial backfill shall be placed to anchor the pipe, protect the pipe from damage by subsequent backfill and ensure the uniform distribution of the loads over the top of the pipe.
- B. Place initial backfill material carefully around the pipe in uniform layers to a depth of at least 18-inches above the pipe barrel. Layer depths shall be a maximum of 6-inches for pipe 18-inches in diameter and smaller and a maximum of 12-inches for pipe larger than 18-inches in diameter.
- C. Backfill on both sides of the pipe simultaneously to prevent side pressures.
- D. Compact each layer thoroughly with suitable hand tools or tamping equipment.
- E. Initial backfill shall be compacted to a minimum 90 percent of the maximum dry density, unless shown or specified otherwise.
- F. If materials excavated from the trench are not suitable for use as backfill materials, provide select backfill material conforming to the requirements of this Section.

3.08 Concrete Encasement

- A. Where concrete encasement is shown on the Drawings, excavate the trench to provide a minimum of 6-inches clearance from the bell of the pipe. Lay the pipe to line and grade on concrete blocks. In lieu of bedding, haunching and initial backfill, place concrete to the full width of the trench and to a height of not less than 6-inches above the pipe bell. Do not backfill the trench for a period of at least 24 hours after concrete is placed.

3.09 Final Backfill

- A. Backfill carefully to restore the ground surface to its original condition.
- B. The top 6-inches shall be topsoil obtained as specified in Article 3.01 of this Section.
- C. Excavated material which is unsuitable for backfilling, and excess material, shall be disposed of, at no additional cost to the Owner, in a manner approved by the Engineer. Surplus soil may be neatly distributed and spread over the site, if approved by the Engineer. If such spreading is allowed, the site shall be left in a clean and sightly condition and shall not affect pre-construction drainage patterns. Surplus rock from the trenching operations shall be removed from the site.
- D. If materials excavated from the trench are not suitable for use as backfill materials, provide select backfill material conforming to the requirements of this Section.
- E. After initial backfill material has been placed and compacted, backfill with final backfill material. Place backfill material in uniform layers, compacting each layer thoroughly as follows:

1. In 6-inch layers, if using light power tamping equipment, such as a “jumping jack”.
 2. In 12-inch layers, if using heavy tamping equipment, such as hammer with tamping feet.
 3. In 24-inch layers, if using a hydra-hammer.
- F. Settlement: If trench settles, re-fill and grade the surface to conform to the adjacent surfaces.
- G. Final backfill shall be compacted to a minimum 90 percent of the maximum dry density, unless specified otherwise.

3.10 Additional Material

Where final grades above the pre-construction grades are required to maintain minimum cover, additional fill material will be as shown on the Drawings. Utilize excess material excavated from the trench, if the material is suitable. No additional payment will be made for additional material when excavated materials are used. If excess excavated materials are not suitable, or if the quantity available is not sufficient, provide additional suitable fill material.

3.11 Backfill under Roads

Compact backfill underlying pavement and sidewalks, and backfill under dirt and gravel roads to a minimum 95 percent of the maximum dry density. The top 12-inches shall be compacted to a minimum of 98 percent of the maximum dry density.

3.12 Backfill within South Carolina DOT Right-of-Way

Backfill within the South Carolina DOT right-of-way shall meet the requirements stipulated in “A Policy for Accommodating Utilities on Highway Rights-of-Way”, published by the South Carolina Department of Transportation.

3.13 Backfill along Restrained Joint Pipe

Backfill along restrained joint pipe shall be compacted to a minimum 90 percent of the maximum dry density.

3.14 Detection Tape and Wire

Where required, detection tape shall be buried 4 to 10-inches beneath the ground surface directly over the top of the pipe. Should detection tape need to be installed deeper, the Contractor shall provide 3-inch wide tape. In no case shall detection tape be buried greater than 20-inches from the finished grade surface. 12-Gauge detection

wire shall be installed as shown on the details. Detection wire shall be taped to the top of pipe at 10 feet intervals. The wire shall be continuous between appurtenances; and, a minimum of 36-inches shall be coiled in each appurtenance enclosure for easy attachment thereto of locator equipment. The wire shall be single conductor copper #12 AWG, or minimum, with 600v gasoline and oil resistant insulation.

3.15 Testing and Inspection (If Required)

- A. The soil testing will be performed by an independent testing laboratory selected by the Contractor.
- B. The soils testing laboratory is responsible for the following:
 - 1. Compaction tests in accordance with Article 1.02 of this Section.
 - 2. Field density tests for each two feet of lift, one test for each 2,000 feet of pipe installed or more frequently if ordered by the Engineer.
 - 3. Inspecting and testing stripped site, subgrades and proposed fill materials.
- C. The Contractor's duties relative to testing include:
 - 1. Notifying laboratory of conditions requiring testing.
 - 2. Coordinating with laboratory for field testing.
 - 3. Paying costs for additional testing performed beyond the scope of that required and for re-testing where initial tests reveal non-conformance with specified requirements.
 - 4. Providing excavation as necessary for laboratory personnel to conduct tests.
- D. Inspection
 - 1. Earthwork operations, acceptability of excavated materials for bedding or backfill, and placing and compaction of bedding and backfill is subject to inspection by the Engineer.
 - 2. Foundations and shallow spread footing foundations are required to be inspected by a geotechnical engineer, who shall verify suitable bearing and construction.
- E. Comply with applicable codes, ordinances, rules, regulations and laws of local, municipal, state or federal authorities having jurisdiction.

END OF SECTION

Part 1 General

1.01 Scope

- A. The work covered by this Section includes furnishing all labor, materials and equipment required to bore and jack casings and to properly complete pipeline construction as described herein and/or shown on the Drawings.
- B. Supply all materials and perform all work in accordance with applicable American Society for Testing and Materials (ASTM), American Water Works Association (AWWA), American National Standards Institute (ANSI) or other recognized standards. Latest revisions of all standards are applicable. If requested by the Engineer, submit evidence that manufacturer has consistently produced products of satisfactory quality and performance over a period of at least two years.

1.02 Submittals

- A. Submit shop drawings, product data and experience in accordance with the requirements of Section 01340 of these Specifications.
- B. Material Submittals: The Contractor shall provide shop drawings and other pertinent specifications and product data as follows:
 - 1. Shop drawings for casing pipe showing sizes and connection details.
 - 2. Design mixes for concrete and grout.
 - 3. Casing Spacers and appurtenances.
- C. Experience Submittals

Boring and jacking casings is deemed to be specialty contractor work. If the Contractor elects to perform the work, the Contractor shall provide evidence as required by the General Conditions. A minimum of five continuous years of experience in steel casing construction is required of the casing installer. Evidence of this experience must be provided with the shop drawings for review by the Engineer.

1.03 Storage and Protection

All materials shall be stored and protected in accordance with the manufacturer's recommendations and as approved by the Engineer.

Part 2 Products

2.01 Materials and Construction

A. Casing

1. The casing shall be new and unused pipe. The casing shall be made from steel plate having a minimum yield strength of 35,000 psi. The steel plate shall also meet the chemical requirements of one of the following: ASTM A36; ASTM A139, Grade B, C, D or E; ASTM A53, Type S or Type E, Grade A or B.
2. The thicknesses of casing shown in paragraph B. below are minimum thicknesses. Actual thicknesses shall be determined by the casing installer, based on an evaluation of the required forces to be exerted on the casing when jacking. Any buckling of the casing due to jacking forces shall be repaired at no additional cost to the Owner.
3. The diameters of casing shown in paragraph B. below and shown on the Drawings are minimum. Larger casings, with the Engineer's approval, may be provided at no additional cost to the Owner, for whatever reasons the Contractor may decide, whether casing size availability, line and grade tolerances, soil conditions, etc.

B. Casing Sizes*

Pipe Diameter, inches	UNDER RAILROADS			UNDER HIGHWAYS	
	Casing Diameter, inches	Wall Thickness, inches		Casing Diameter, inches	Wall Thickness, inches
		Coated	Uncoated		
6	14	0.250	0.282	12	0.250
8	18	0.250	0.313	16	0.250
10	20	0.281	0.344	16	0.250
12	22	0.312	0.375	18	0.250
14	24	0.344	0.407	22	0.250
16	30	0.406	0.469	24	0.250
18	30	0.406	0.469	30	0.312
20	32	0.438	0.501	30	0.312
24	36	0.469	0.532	36	0.375

*Use sizes above unless otherwise directed.

- C. Casing Spacers: Casing spacers shall meet one of the following requirements:
1. Casing spacers shall be flanged, bolt-on style with a two-section stainless steel shell lined with a PVC liner, minimum 0.09-inch thick also having a hardness of 85-90 durometer. Runners shall be attached to stainless steel risers which shall be properly welded to the shell. The height of the runners and risers shall be manufactured such that the pipe does not float within the casing.
 2. Casing spacers shall be a two-section, flanged, bolt on style constructed of heat fused PVC coated steel, minimum 14 gauge band and 10 gauge risers, with 2-inch wide glass reinforced polyester insulating skids, heavy duty PVC inner liner, minimum 0.09-inch thick having a hardness of 85-90 durometer, and all stainless steel or cadmium plated hardware.
 3. Casing spacers shall be as specified in Appendix A (Approved Manufacturers List)
- D. End Seals: Ends shall be sealed with casing end seals as specified in Appendix A (Approved Manufacturers List).
- E. Carrier Pipe: Carrier pipes shall meet requirements as specified in Section 02665 of these Specifications.

2.02 Equipment

A cutting head shall be attached to a continuous auger mounted inside the casing pipe.

Part 3 Execution

3.01 General

- A. Interpretation of soil investigation reports and data, investigating the site and determination of the site soil conditions prior to bidding is the sole responsibility of the Contractor. Any subsurface investigation by the Bidder or Contractor must be approved by the appropriate authority having jurisdiction over the site. Rock and/or water, if encountered, shall not entitle the Contractor to additional compensation.
- B. Casing construction shall be performed so as not to interfere with, interrupt or endanger roadway surface and activity thereon, and minimize subsidence of the surface, structures, and utilities above and in the vicinity of the casing. Support the ground continuously in a manner that will prevent loss of ground and keep the perimeters and face of the casing, passages and shafts stable. The Contractor shall be responsible for all settlement resulting from casing operations and shall repair and restore damaged property to its original or better condition at no cost to the Owner.
- C. Face Protection: The face of the excavation shall be protected from the collapse of the soil into the casing.

- D. Casing Design: Design of the bore pit and required bearing to resist jacking forces is the responsibility of the Contractor. The excavation method selected shall be compatible with expected ground conditions. The lengths of the casing shown on the Drawings are the minimum lengths required. The length of the casing may be extended for the convenience of the Contractor, at no additional cost to the Owner. Due to restrictive right-of-way and construction easements, boring and jacking casing lengths less than the nominal 20 foot length may be necessary.

E. Highway Crossings

1. The Contractor shall be held responsible and accountable for the coordinating and scheduling of all construction work within the highway right-of-way.
2. Work along or across the highway department rights-of-way shall be subject to inspection by such highway department.
3. All installations shall be performed to leave free flows in drainage ditches, pipes, culverts or other surface drainage facilities of the highway, street or its connections.
4. No excavated material or equipment shall be placed on the pavement or shoulders of the roadway without the express approval of the highway department.
5. In no instance will the Contractor be permitted to leave equipment (trucks, backhoes, etc.) on the pavement or shoulder overnight. Construction materials to be installed, which are placed on the right-of-way in advance of construction, shall be placed in such a manner as not to interfere with the safe operation of the roadway.

F. Railroad Crossings

1. The Contractor shall secure permission from the Railroad to schedule work so as not to interfere with the operation of the Railroad.
2. If required by the Owner, additional insurance is required for each railroad crossing. The Contractor shall furnish the Railroad with such additional insurance as may be needed, cost of the same shall be borne by the Contractor. A copy of policy and proof of payment must be supplied.
3. All work on the Railroad right-of-way, including necessary support of tracks, safety of operations and other standard and incidental operation procedures may be under the supervision of the appropriate authorized representative of the Railroad affected and any decisions of this representative pertaining to construction and/or operations shall be final and construction must be governed by such decisions.
4. If, in the opinion of the Railroad, it becomes necessary to provide flagging protection, watchmen or the performance of any other work in order to keep the

tracks safe for traffic, the Contractor shall coordinate such work and shall reimburse the Railroad, in cash, for such services, in accordance with accounting procedures agreed on by the Contractor and affected Railroad before construction is started.

5. No blasting shall be permitted within the Railroad right-of-way.

3.02 Groundwater Control

- A. The Contractor shall control the groundwater throughout the construction of the casing.
- B. Methods of dewatering shall be at the option and responsibility of the Contractor. Maintain close observation to detect settlement or displacement of surface facilities due to dewatering. Should settlement or displacement be detected, notify the Engineer immediately and take such action as necessary to maintain safe conditions and prevent damage.
- C. When water is encountered, provide and maintain a dewatering system of sufficient capacity to remove water on a 24 hour basis keeping excavations free of water until the backfill operation is in progress. Dewatering shall be performed in such a manner that removal of soil particles is held to a minimum. Dewater into a sediment trap and comply with requirements specified in Section 02125 of these Specifications.

3.03 Safety

- A. Provide all necessary bracing, bulkheads and shields to ensure complete safety to all traffic, persons and property at all times during the work. Perform the work in such a manner as to not permanently damage the roadbed or interfere with normal traffic over it.
- B. Observe all applicable requirements of the regulations of the authorities having jurisdiction over this site. Conduct the operations in such a manner that all work will be performed below the level of the roadbed.
- C. Perform all activities in accordance with the Occupational Safety and Health Act of 1970 (PL-596), as amended, applicable regulations of the Federal Government, OSHA 29CFR 1926 and applicable criteria of ANSI A10.16-81, "Safety Requirements for Construction of Tunnel Shafts and Caissons".

3.04 Boring and Jacking

- A. Shaft
 1. Conduct boring and jacking operations from a shaft excavated at one end of the

section to be bored. Where conditions and accessibility are suitable, place the shaft on the downstream end of the bore.

2. The shaft shall be rectangular and excavated to a width and length required for ample working space. If necessary, sheet and shore shaft properly on all sides. Shaft sheeting shall be timber or steel piling of ample strength to safely withstand all structural loadings of whatever nature due to site and soil conditions. Keep preparations dry during all operations. Perform pumping operations as necessary.
3. The bottom of the shaft shall be firm and unyielding to form an adequate foundation upon which to work. In the event the shaft bottom is not stable, excavate to such additional depth as required and place a gravel sub-base or a concrete sub-base if directed by the Engineer due to soil conditions.

B. Jacking Rails and Frame

1. Set jacking rails to proper line and grade within the shaft. Secure rails in place to prevent settlement or movement during operations. The jacking rails shall cradle and hold the casing pipe on true line and grade during the progress of installing the casing.
2. Place backing between the heels of jacking rails and the rear of the shaft. The backing shall be adequate to withstand all jacking forces and loads.
3. The jacking frame shall be of adequate design for the magnitude of the job. Apply thrust to the end of the pipe in such a manner to impart a uniformly balanced load to the pipe barrel without damaging the joint ends of the pipe.

- C. Boring and jacking of casing pipes shall be accomplished by the dry auger boring method without jetting, sluicing or wetboring.
- D. Auger the hole and jack the casing through the soil simultaneously.
- E. Bored installations shall have a bored-hole diameter essentially the same as the outside diameter of the casing pipe to be installed.
- F. Execute boring ahead of the casing pipe with extreme care, commensurate with the rate of casing pipe penetration. Boring may proceed slightly in advance of the penetrating pipe and shall be made in such a manner to prevent any voids in the earth around the outside perimeter of the pipe. Make all investigations and determine if the soil conditions are such as to require the use of a shield.
- G. As the casing is installed, check the horizontal and vertical alignment frequently. Make corrections prior to continuing operation. For casing pipe installations over 100 feet in length, the auger shall be removed and the alignment and grade checked at minimum intervals of 60 feet.
- H. Any casing pipe damaged in jacking operations shall be repaired, if approved by the Engineer, or removed and replaced at Contractor's own expense.

- I. Lengths of casing pipe, as long as practical, shall be used except as restricted otherwise. Joints between casing pipe sections shall be butt joints with complete joint penetration, single groove welds, for the entire joint circumference, in accordance with AWS recommended procedures. Prior to welding the joints, the Contractor shall ensure that both ends of the casing sections being welded are square.
- J. The Contractor shall prepare a contingency plan which will allow the use of a casing lubricant, such as bentonite, in the event excessive frictional forces jeopardize the successful completion of the casing installation.
- K. Once the jacking procedure has begun, it should be continued without stopping until completed, subject to weather and conditions beyond the control of the Contractor.
- L. Care shall be taken to ensure that casing pipe installed by boring and jacking method will be at the proper alignment and grade.
- M. The Contractor shall maintain and operate pumps and other necessary drainage system equipment to keep work dewatered at all times.
- N. Adequate sheeting, shoring and bracing for embankments, operating pits and other appurtenances shall be placed and maintained to ensure that work proceeds safely and expeditiously. Upon completion of the required work, the sheeting, shoring and bracing shall be left in place, cut off or removed, as designated by the Engineer.
- O. Trench excavation, all classes and type of excavation, the removal of rock, muck, debris, and the excavation of all working pits and backfill requirements of Section 02225 are included under this Section.
- P. All surplus material shall be removed from the right-of-way and the excavation finished flush with the surrounding ground.
- Q. Grout backfill shall be used for unused holes or abandoned pipes.

3.06 Free Boring

- A. Where the Drawings indicate a pipeline is to be installed by boring without steel casing, the Contractor shall construct the crossing by the free bore method. The free bore method shall be accomplished by the dry auger boring method without jetting, sluicing, or wet boring.
- B. The diameter of the free bore shall not exceed the pipe bell or pvc casing pipe barrel outside diameter or the pipe barrel outside diameter plus 1-inch, whichever is greater.
- C. Free boring, where indicated on the Drawings, is to be performed at the Contractor's option. The Contractor may choose to construct the crossing by the conventional bore and jack casing methodology.

- D. The Contractor shall be responsible for any settlement of the roadway caused by the free bore construction activities.
- E. If the Contractor elects to free bore, and an acceptable installation does not result for any reason, the Contractor shall install a casing pipe by the bore and jack method at no additional cost to the Owner.

3.07 Ventilation and Air Quality

Provide, operate and maintain for the duration of casing project a ventilation system to meet safety and OSHA requirements.

3.08 Rock Excavation

- A. In the event that rock is encountered during the installation of the casing pipe which, in the opinion of the Engineer, cannot be removed through the casing, the Engineer may authorize the Contractor to complete the crossing with a tunnel.
- B. At the Contractor's option, the Contractor may continue to install the casing and remove the rock through the casing at no additional cost to the Owner.

3.09 Installation of Pipe

- A. After construction of the casing is complete, and has been accepted by the Engineer, install the pipeline in accordance with the Drawings and Specifications.
- B. Check the alignment and grade of the casing and prepare a plan to set the pipe at proper alignment, grade and elevation, without any sags or high spots.
- C. The pipe shall be supported within the casing by use of casing spacers sized to limit radial movement to a maximum of 1-inch. Provide a minimum of two casing spacers per nominal length of pipe. Casing spacers shall be attached to the pipe at minimum 10 foot intervals. All joints of pipe inside the casing shall be equipped with restrained joints.
- D. Close the ends of the casing with 4-inch brick walls.

3.10 Sheet Pile Removal

Remove sheet piling used for shoring from the shaft and off the job site. The removal of sheet piling, shoring and bracing shall be done in such a manner as not to endanger or damage either new or existing structures, private or public properties and also to avoid cave-ins or sliding in the banks.

3.11 Interstate Restoration

When boring and jacking operations encroach upon the right-of-ways of the federal interstate system, the Contractor shall restore all screening trees with seedlings of like species.

END OF SECTION

Part 1 General

1.01 Scope

The work described in this section are guidelines, understanding County and State regulation prevail.

The work to be performed under this Section shall consist of removing and replacing existing pavement, driveways, sidewalks and curbs in paved areas where such have been removed for construction of water mains, fire hydrants, and all other water appurtenances and structures.

1.02 Submittals

- A. Certificates: If required, provide certificates stating that materials supplied comply with Specifications. Certificates shall be signed by the asphalt producer and the Contractor.
- B. Mix Design: Submit mix design for each course to the Engineer for acceptance.
- C. Asphalt spreader equipment shall be approved by the Engineer. Submit design and operational data.

1.03 Conditions

- A. Weather Limitations
 - 1. Do not conduct paving operations when surface is wet or contains excess of moisture which would prevent uniform distribution and required penetration.
 - 2. Construct prime and tack coats, and asphaltic courses only when atmospheric temperature in the shade is above 40 degrees F, when the underlying base is dry and when weather is not rainy.
 - 3. Place base course when air temperature is above 35 degrees F and rising.
- B. Grade Control: Establish and maintain the required lines and grades for each course during construction operations.

1.04 Inspection and Testing

- A. If required, pavement and base testing will be performed by an independent testing laboratory selected by the Owner.
- B. The testing agency shall test in-place courses for compliance with specified compaction, thickness and surface smoothness requirements.

- C. The testing agency shall take one 4-inch diameter core per 1,000 square yards of paved surface at locations selected by the Engineer for density and thickness tests. Repair holes resulting from coring to match existing paving.
- D. Compaction
 - 1. Aggregate Base: Type A base shall be compacted to 100 percent of the maximum theoretical density based upon bulk specific gravity as determined by AASHTO T 84 and T 85.
 - 2. Asphalt Aggregate Base: The bituminous base shall be compacted to 90 percent of the maximum theoretical density. No individual density shall be less than 87 percent of the maximum theoretical density.
 - 3. Asphaltic Concrete Binder and Surface Courses: Compare density of in-place material against laboratory specimen of same mixture, subjected to 75 blows of a Standard Marshall hammer on each side of specimen. Minimum acceptable density of in-place material shall be 93 percent of recorded laboratory specimen density. No individual test shall be less than 90 percent of laboratory density. It is intended that acceptance density testing will be accomplished while the bituminous mixture is hot enough to permit further densification if such is shown to be necessary. If the density does not conform to the requirements stated herein above, the Contractor shall continue compactive effort until the required density is obtained.
- E. Concrete Strength: One set of acceptance and field concrete cylinders (a total of four) and one set of acceptance concrete beams (a total of four) from the same batch of concrete will be made for each 50 cubic yards or fraction thereof, not less than one set of each 5,000 square feet of pavement in each day's placing of each class and mix design.
 - 1. Each batch of concrete shall be tested for slump prior to placement. Slump shall be between 1/2 and 1-1/2-inches as determined by AASHTO Test Method T 119.
 - 2. Acceptance cylinders are compression test cylinders molded in the field, stored and cured in the field for the first 24 hours after molding and thereafter in the laboratory of the testing agency until time of testing. Average breaking strength at 14 days of a set of two acceptance cylinders will comprise a test. Minimum compressive strength shall be 3,500 psi when tested in accordance with AASHTO T 22.
 - 3. Field cylinders are compression test cylinders molded in the field, stored and cured on the work site in the same location and subject to the same exposure as job concrete of which it is a representative. Each set of two acceptance cylinders will have two matching field cylinders.
 - 4. Acceptance concrete beams are flexural test beams molded in 6 x 6 x 20-inch steel molds in the field, stored and cured in the field for the first 24 hours after molding and thereafter in the laboratory of the testing agency until time of

testing. Average flexural strength at 14 days of a set of two acceptance beams will comprise a test. Minimum flexural strength shall be 550 psi when tested in accordance with AASHTO T 97.

5. One field cylinder and beam will be broken at seven days and the remaining will be held in reserve.

F. Allowable Variation in Thickness

1. Aggregate Base Course: $\pm 1/2$ -inch.
2. Asphalt Base: $\pm 1/2$ -inch.
3. Asphalt Concrete Aggregate Binder Course: $\pm 1/4$ -inch.
4. Asphalt Concrete Surface Course: $\pm 1/8$ -inch.
5. Concrete Pavement: $\pm 1/4$ -inch.

G. Surface Smoothness: Test finished surface of each asphalt course for smoothness using a 10 foot straightedge. Intervals of tests shall be as directed by the Engineer. Surfaces will not be acceptable if exceeding the following:

1. Aggregate Base Course: $3/8$ -inch in 10 feet.
2. Asphalt Base: $3/8$ -inch in 10 feet.
3. Asphalt Concrete Aggregate Binder Course: $1/4$ -inch in 10 feet.
4. Asphalt Concrete Surface Course: $1/8$ -inch in 10 feet.
5. Concrete Pavement: $1/8$ -inch in 10 feet.

H. Contractor's Duties Relative to Testing

1. Notifying laboratory of conditions requiring testing.
2. Coordinating with laboratory for field testing.
3. Paying costs for additional testing performed beyond the scope of that required and for retesting where initial tests reveal nonconformance with specified requirements.

Part 2 Products

2.01 Materials

- A. Stabilized Aggregate Base Course: Stabilized aggregate base course shall conform to the requirements of the South Carolina Department of Transportation Standard Specifications, Section 306, Grading Type 1.
- B. Hot Laid Asphalt Aggregate Base Course: The base of all paved roadways shall conform to the requirements of Section 310 of the South Carolina Department of Transportation Standard Specifications.
- C. Hot Laid Asphalt Concrete Binder Course: The binder course of all paved roadways shall conform to the requirements of Section 402 and applicable portions of Section 401 of the South Carolina Department of Transportation Standard Specifications.
- D. Hot Laid Asphalt Concrete Surface Course: The surface course for all pavement shall conform to the requirements of the South Carolina Department of Transportation Standard Specifications, Section 403 and applicable portions of Section 401, for Asphaltic Concrete, Type 1.
- E. Bituminous Surfacing Double Treatment: The surface for all pavements shall conform to the requirements of the South Carolina Department of Transportation Standard Specifications, Section 406 for Types 1 or 2.
- F. Concrete: Provide concrete and reinforcing for concrete pavement or base courses in accordance with the requirements of the South Carolina Department of Transportation Standard Specifications, Section 501.
- G. Special Surfaces: Where driveways or roadways are disturbed or damaged which are constructed of specialty type surfaces, e.g., brick or stone, these driveways and roadways shall be restored utilizing similar, if not original, materials. Where the nature of these surfaces dictate, a specialty contractor shall be used to restore the surfaces to their previous or better condition. Special surfaces shall be removed and replaced to the limits to which they were disturbed.

2.02 Types of Pavements

- A. General: All existing pavement removed, destroyed or damaged by construction shall be replaced with the same type and thickness of pavement as that existing prior to construction, unless otherwise directed by the Engineer. Materials, equipment and construction methods used for paving work shall conform to the South Carolina Department of Transportation specifications applicable to the particular type required for replacement, repair or new pavements.
- B. Aggregate Base: Aggregate base shall be constructed in accordance with the requirements of Section 306 of the South Carolina Department of Transportation Standard Specifications. Material shall be mixed and placed by the stationary plant method. If the finished compacted base course depth is 8-inches or more, the course

shall be constructed in two or more layers of approximately equal thickness.

- C. Concrete Pavement: Concrete pavement or base courses shall be replaced with concrete. The surface finish of the replaced concrete pavement shall conform to that of the existing pavement. The surface of the replaced concrete base course shall be left rough. The slab depth shall be equivalent to the existing concrete pavement or base course, but in no case less than 6-inches thick. Transverse and longitudinal joints removed from concrete pavement shall be replaced at the same locations and to the same types and dimensions as those removed. Concrete pavements or concrete base courses shall be reinforced and shall conform to South Carolina Department of Transportation Standard Specifications, Section 501.
- D. Asphalt Concrete Base, Binder and Surface Course: Asphalt aggregate base; and asphalt concrete binder and surface course construction shall conform to South Carolina Department of Transportation Standard Specifications, Section 310 for base course and Section 400 for binder and surface course. The pavement mixture shall not be spread until the designated surface has been previously cleaned and prepared, is intact, compacted as specified herein, properly cured, dry and the prime and/or tack coat has been applied. Apply and compact the asphalt concrete in maximum layer thickness by asphalt spreader equipment of design and operation approved by the Engineer. After compaction, the asphalt concrete shall be smooth and true to established profiles and sections. Immediately correct any high, low or defective areas by cutting out the course, replacing with fresh hot mix, and immediately compacting to conform and thoroughly bond to the surrounding area.
- E. Bituminous Surfacing Double Treatment: Bituminous surfacing double treatment shall be replaced with a minimum thickness of 1-inch conforming to Section 406 for Type 1 or 2, of the South Carolina Department of Transportation Standard Specifications. No bituminous surface shall be installed between October 15 and March 15, and only when the air and pavement temperatures in the shade are above 60 degrees F.
- F. Gravel Surfaces: Existing gravel road, drive and parking area replacement shall meet the requirements of aggregate base course. This surfacing may be authorized by the Engineer as a temporary surface for paved streets until replacement of hard surfaced pavement is authorized.
- G. Temporary Measures: During the time period between pavement removal and complete replacement of permanent pavement, maintain highways, streets and roadways by the use of steel running plates anchored to prevent movement. The backfill above the pipe shall be compacted, as specified elsewhere, up to the existing pavement surface to provide support for the steel running plates. All pavement shall be replaced within seven calendar days of its removal.

Part 3 Execution

3.01 Removing Pavement

- A. General: Remove existing pavement as necessary for installing the pipe line and appurtenances.
- B. Marking: Before removing any pavement, mark the pavement neatly paralleling pipe lines and existing street lines. Space the marks the width of the trench.
- C. Breaking: Break asphalt pavement along the marks using pavement shearing equipment, jack hammers or other suitable tools. Break concrete pavement along the marks by scoring with a rotary saw and breaking below the score by the use of jack hammers or other suitable tools.
- D. Machine Pulling: Do not pull pavement with machines until the pavement is completely broken and separated from pavement to remain.
- E. Damage to Adjacent Pavement: Do not disturb or damage the adjacent pavement. If the adjacent pavement is disturbed or damaged, remove and replace the damaged pavement.
- F. Damage to Traffic Signal Loops: Any pavement removal which will include removal of traffic signal loops embedded in the pavement shall be coordinated with the Traffic Engineering Department having jurisdiction over the traffic signal five days prior to pavement removal.
- G. Sidewalk: Remove and replace any sidewalks disturbed by construction for their full width and to the nearest undisturbed joint.
- H. Curbs: Tunnel under or remove and replace any curb disturbed by construction to the nearest undisturbed joint.

3.02 Replacing Pavement

- A. Preparation of Subgrade: During backfilling and compaction of the backfill, arrange to have the compaction tested by an independent testing laboratory. After compaction testing has been satisfactorily completed, replace all pavements, sidewalks and curbs removed.
 - 1. The existing street pavement or surface shall be removed along the lines of the work for the allowable width specified for the trench or structure. After the installation of water works facilities and after the backfill has been compacted suitably, the additional width of pavement to be removed, as shown on the Drawings, shall be done immediately prior to replacing the pavement.
 - 2. Trench backfill shall be compacted for the full depth of the trench as specified in Section 02225 of these Specifications.

3. Temporary trench backfill along streets and driveways shall include 6-inches of crushed stone as a temporary surfacing of the trenches. This temporary surface shall be maintained carefully at grade and dust-free by the Contractor until the backfill of the trench has thoroughly compacted in the opinion of the Engineer and permission is granted to replace the street pavement.
4. When temporary crushed stone is considered by the Engineer to be sufficient surface for gravel pavement, the surface shall be graded smooth and to an elevation that will make the final permanent surfacing level with the adjacent surfacing that was undisturbed.

B. Pavement Replacement

1. Prior to replacing pavement, make a final cut in concrete pavement 12-inches back from the edge of the damaged pavement with a concrete saw. Remove asphalt pavement 12-inches back from the edge of the damaged pavement using pavement shearing equipment, jack hammers or other suitable tools.
2. Replace all street and roadway pavement as shown on the Drawings. Replace driveways, sidewalks and curbs with the same material, to nearest existing undisturbed construction joint and to the same dimensions as those existing.
3. If the temporary crushed stone is to be replaced, the top 6-inches shall be removed and the crushed stone surfacing for unpaved streets or the base for the bituminous surface shall be placed.
4. Following this preparation, the crushed stone base shall be primed with a suitable bituminous material and surfaced with the proper type of bituminous surface treatment.
5. Where the paved surface is to be replaced with asphaltic concrete pavement, concrete pavement or with a concrete base and a surface course, the temporary crushed stone surface and any necessary backfill material, additional existing paving and new excavation shall be removed to the depth and width shown on the Drawings. All edges of the existing pavement shall be cut to a straight, vertical edge. Care shall be used to get a smooth joint between the old and new pavement and to produce an even surface on the completed street. Concrete base slabs and crushed stone bases, if required, shall be placed and allowed to cure for three days before bituminous concrete surface courses are applied. Expansion joints, where applicable, shall be replaced in a manner equal to the original joint.
6. Where driveways or roadways, constructed of specialty type surfaces, e.g. brick or stone are disturbed or damaged, these driveways and roadways shall be restored utilizing similar materials. Where the nature of these surfaces dictate, a specialty contractor shall be used to restore the surfaces to their previous or better condition. Special surfaces shall be removed and replaced to the limits to which they were disturbed.

C. Pavement Resurfacing

1. Certain areas to be resurfaced are specified or noted on the Drawings. Where pavement to be resurfaced has been damaged with potholes, the Contractor shall remove all existing loose pavement material and fill the hole with Asphalt Aggregate Base Course, as specified, to the level of the existing pavement. After all pipe line installations are complete and existing pavement has been removed and replaced along the trench route, apply tack coat and surface course as specified.
2. Resurfacing limits shall be perpendicular to the road centerline. The limits of resurfacing shall be 10 feet beyond the edge of the pavement replacement on the main road being resurfaced, and to the point of tangency of the pavement on the side streets.

D. Pavement Striping: Pavement striping removed or paved over shall be replaced with the same type, dimension and material as original unless directed otherwise by the Engineer.

E. Traffic Signal Loops: The replacement or repair of all traffic signal loops removed or damaged during the removal and replacement of pavement shall be coordinated by the Contractor with the Traffic Engineering Department having jurisdiction over each traffic signal. The Contractor shall be responsible for payment of all fees associated with replacement or repair of traffic signal loops.

3.03 Sidewalk and Curb Replacement

A. Construction

1. All concrete sidewalks and curbs shall be replaced with concrete.
2. Preformed joints shall be 1/2-inch thick, conforming to the latest edition of AASHTO M 59 for sidewalks and AASHTO M 123 for curbs.
3. Forms for sidewalks shall be of wood or metal, shall be straight and free from warp, and shall be of sufficient strength, when in place, to hold the concrete true to line and grade without springing or distorting.
4. Forms for curbs shall be metal and of an approved section. They shall be straight and free from distortions, showing no vertical variation greater than 1/8-inch in 10 feet and no lateral variation greater than 1/4-inch in 10 feet from the true plain surface on the vertical face of the form. Forms shall be of the full depth of the structure and constructed such to permit the inside forms to be securely fastened to the outside forms.
5. Securely hold forms in place true to the lines and grades indicated on the Drawings.

6. Wood forms may be used on sharp turns and for special sections, as approved by the Engineer. Where wooden forms are used, they shall be free from warp and shall be the nominal depth of the structure.
 7. All mortar and dirt shall be removed from forms and all forms shall be thoroughly oiled or wetted before any concrete is deposited.
- B. When a section is removed, the existing sidewalk or curb shall be cut to a neat line, perpendicular to both the centerline and the surface of the concrete slab. Existing concrete shall be cut along the nearest existing construction joints; if such joints do not exist, the cut shall be made at minimum distances shown on the Drawings.
- C. Existing concrete sidewalks and curbs that have been cut and removed for construction purposes shall be replaced with the same width and surface as the portion removed. Sidewalks shall have a minimum uniform thickness of 4-inches. The new work shall be neatly jointed to the existing concrete so that the surface of the new work shall form an even, unbroken plane with the existing surfaces.
- D. The subgrade shall be formed by excavating to a depth equal to the thickness of the concrete, plus 2-inches. Subgrade shall be of such width as to permit the proper installation and bracing of the forms. Subgrades shall be compacted by hand tamping or rolling. Soft, yielding or unstable material shall be removed and backfilled with satisfactory material. Place 2-inches of porous crushed stone under all sidewalks and curbs and compact thoroughly, then finish to a smooth, unyielding surface at proper line, grade and cross section.
- E. Joint for Curbs
1. Joints shall be constructed as indicated on the Drawings and as specified. Construct joints true to line with their faces perpendicular to the surface of the structure and within 1/4-inch of their designated position.
 2. Thoroughly spade and compact the concrete at the faces of all joints filling all voids.
 3. Install expansion joint materials at the point of curve at all street returns. Install expansion joint material behind the curb at abutment to sidewalks and adjacent structures.
 4. Place contraction joints every 10 feet along the length of the curbs and gutters. Form contraction joints using steel templates or division plates which conform to the cross section of the structure. Leave the templates in place until the concrete has set sufficiently to hold its shape, but remove them while the forms are still in place. Contraction joint templates or plates shall not extend below the top of the steel reinforcement or they shall be notched to permit the reinforcement to be continuous through the joint. Contraction joints shall be a minimum of 1-1/2-inches deep.

- F. Expansion joints shall be required to replace any removed expansion joints or in new construction wherever shown on the Drawings. Expansion joints shall be true and even, shall present a satisfactory appearance, and shall extend to within 1/2-inch of the top of finished concrete surface.
- G. Finishing
 - 1. Strike off the surface with a template and finish the surface with a wood float using heavy pressure, after which, contraction joints shall be made and the surface finished with a wood float or steel trowel.
 - 2. Finish the face of the curbs at the top and bottom with an approved finishing tool of the radius indicated on the Drawings.
 - 3. Finish edges with an approved finishing tool having a 1/4-inch radius.
 - 4. Provide a final broom finish by lightly combing with a stiff broom after troweling is complete.
 - 5. The finished surface shall not vary more than 1/8-inch in 10 feet from the established grade.
- H. Driveway and Sidewalk Ramp Openings
 - 1. Provide driveway openings of the widths and at the locations indicated on the Drawings and as directed by the Engineer.
 - 2. Provide sidewalk ramp openings as indicated on the Drawings, in conformance with the applicable regulations and as directed by the Engineer.
- I. Concrete shall be suitably protected from freezing and excessive heat. It shall be kept covered with burlap or other suitable material and kept wet until cured. Provide necessary barricades to protect the work. All damage caused by people, vehicles, animals, rain, the Contractor's operations and the like shall be repaired by the Contractor, at no additional expense to the Owner.

3.04 Maintenance

The Contractor shall maintain the surfaces of roadways built and pavements replaced until the acceptance of the Project. Maintenance shall include replacement, scraping, reshaping, wetting and rerolling as necessary to prevent raveling of the road material, the preservation of reasonably smooth surfaces and the repair of damaged or unsatisfactory surfaces, to the satisfaction of the Engineer. Maintenance shall include sprinkling as may be necessary to abate dust from the gravel surfaces.

3.05 Supervision and Approval

- A. Pavement restoration shall meet the requirements of the regulatory agency responsible for the pavement. Obtain agency approval of pavement restorations before requesting final payment.
- B. Obtain the Engineer's approval of restoration of pavement, such as private roads and drives that are not the responsibility of a regulatory agency.
- C. Complete pavement restoration as soon as possible after backfilling.
- D. Failure of Pavement: Should any pavement restoration or repairs fail or settle during the life of the Contract, including the bonded period, promptly restore or repair defects.

3.06 Cleaning

The Contractor shall remove all surplus excavation materials and debris from the street surfaces and rights-of-way and shall restore street, roadway or sidewalk surfacing to its original condition.

END OF SECTION

Part 1 General

1.01 Scope

- A. This Section describes products to be incorporated into the water mains and requirements for the installation and use of these items. Furnish all products and perform all labor necessary to fulfill the requirements of these Specifications.
- B. General: Supply all products and perform all work in accordance with applicable American Society for Testing and Material (ASTM), American Water Works Association (AWWA), American National Standards Institute (ANSI), or other recognized standards. NSF/ASNI Standard 372 (low lead brass).

1.02 Qualifications

If requested by the Engineer, submit evidence that manufacturers have consistently produced products of satisfactory quality and performance for a period of at least two years.

1.03 Submittals

Complete shop drawings and engineering data for all products shall be submitted to the Engineer in accordance with the requirements of Section 01340 of these Specifications.

1.04 Transportation and Handling

- A. Inspection: Each pipe shipment should be inspected carefully upon arrival. The carrier is responsible for delivering the pipe. The receiver must make certain there has been no loss or damage. Should there be any errors or damage; make proper notes on the delivery receipt. Make claim in accordance with the carrier's instruction. Do not dispose of any damaged material. Carrier will advise you of the procedure to follow for freight damage. PVC pipe that is faded will not be accepted.

Pipe at the bottom of the stack may become out-of-round due to the weight of material above it. At normal application temperatures this corrects itself soon after the load is removed. Under freezing conditions this recovery to full initial roundness may take several hours or a few days. (Unusually hot weather conditions may also contribute to a degree of out-of-roundness. Self correction usually occurs as the temperature normalizes.)

- B. Unloading: Furnish equipment and facilities for unloading, handling, distributing and storing pipe, fittings, valves and accessories. Make equipment available at all times for use in unloading. Do not drop or dump materials. Any materials dropped or dumped will be subject to rejection without additional justification. Pipe handled on skids shall not be rolled or skidded against the pipe on the ground. Extra care should be used in handling pipe in cold weather.

- C. Handling: Handle pipe, fittings, valves and accessories carefully to prevent shock or damage. Handle pipe by rolling on skids, forklift, or front-end loader. Do not use material damaged in handling. Slings, hooks or pipe tongs shall be padded and used in such a manner as to prevent damage to the exterior coatings or internal lining of the pipe.
- D. All pipes in transport must be tarped on the front side nearest the truck cab.

1.05 Storage and Protection

- A. Store all pipe which cannot be distributed along the route. Make arrangements for the use of suitable storage areas.
- B. Stored materials shall be kept safe from damage. The interior of all pipes, fittings and other appurtenances shall be kept free from dirt or foreign matter at all times. Valves and hydrants shall be drained and stored in a manner that will protect them from damage by freezing.
- C. Pipe shall not be stacked higher than the limits recommended by the manufacturer. The bottom tier shall be kept off the ground on timbers, rails or concrete. Pipe in tiers shall be alternated: bell, plain end; bell, plain end. At least two rows of timbers shall be placed between tiers and chocks, affixed to each other in order to prevent movement. The timbers shall be large enough to prevent contact between the pipe in adjacent tiers.
- D. Stored mechanical and push-on joint gaskets and PVC pipe shall be placed in a cool location out of direct sunlight. Gaskets shall not come in contact with petroleum products. Gaskets shall be used on a first-in, first-out basis.
- E. Mechanical-joint bolts shall be handled and stored in such a manner that will ensure proper use with respect to types and sizes.

1.06 Quality Assurance

The manufacturer shall provide written certification to the Engineer that all products furnished comply with all applicable requirements of these Specifications.

Part 2 Products

2.01 General

- A. All materials/products that contact potable water must be third party certified as meeting the specifications of ANSI/NSF Standard 61. The certifying party shall be accredited by the ANSI.
- B. All pipe, fittings, packing, jointing materials, valves and fire hydrants shall conform to Section C of the AWWA Standards.
- C. Water mains, which have been previously used for conveying potable water, may be reused, provided they meet applicable criteria from AWWA Section C, ANSI/NSF 61, and ASTM D1785 or D2241. The mains must be thoroughly cleaned and restored practically to their original condition.
- D. Asbestos cement pipe shall not be used in potable water systems except in the repair of existing asbestos cement lines.
- E. Thermoplastic piping shall not be used above grade.
- F. Natural rubber or other material which will support microbiological growth may not be used for any gaskets, O-rings, and other products used for jointing pipes, setting meters or valves, or other appurtenances which will expose the material to the water.
- G. Lubricants, which will support microbiological growth, shall not be used for slip-on joints. Vegetable shortening shall not be used to lubricate joints.
- H. Solvent-weld PVC pipe and fittings shall not be used on PWD owned and maintained piping.
- I. All pipe material, solder and flux shall be lead free (less than 0.2% lead in solder and flux and less than 8.0% lead in pipes and fittings).
- J. No flushing device shall be directly connected to any sewer.
- K. Chambers, pits or manholes containing valves, blow-offs, meters, air relief valves, or other such appurtenances to a distribution system, shall not be connected directly to any storm drain or sanitary sewer.
- L. Installation of water mains and appurtenances shall be conducted in accordance with Section C of the AWWA Standards and/or manufacturer's recommended installation procedures.

2.02 Piping Materials and Accessories

A. Ductile Iron Pipe (DIP)

1. Ductile iron pipe shall be domestically manufactured in the United States in accordance with ANSI/AWWA C110/A21.10, C111/A21.11, C150/A21.50, C151/A21.51, and C153/A21.53. All pipe, except specials, shall be furnished in nominal lengths of 18 to 20 feet. Sizes will be as shown on the Drawings. All pipe shall have a minimum pressure rating as indicated in the following table, and corresponding minimum wall thickness, unless otherwise specified by engineer or shown on the Drawings:

Pipe Sizes (inches)	Pressure Class (psi)
4 - 12	350
14 - 18	350
20	350
24	350

2. Flanged pipe minimum wall thickness shall be equal to Special Class 53 and shall meet ANSI/AWWA C115/A21.15 and ANSI B16.1. Flanges shall be furnished by the pipe manufacturer.
3. Pipe and fittings shall be cement lined in accordance with ANSI/AWWA C104/A21.4. Pipe and fittings shall be furnished with a bituminous outside coating.
4. Fittings shall be ductile iron and shall conform to ANSI/AWWA C110/A21.10 or ANSI/AWWA C153/A21.53 with a minimum rated working pressure of 350 psi.
5. Joints
 - a. Unless shown or specified otherwise, joints shall be push-on or restrained joint type for pipe and standard mechanical, push-on or restrained joints for fittings. Push-on and mechanical joints shall conform to ANSI/AWWA C111/A21.11. Restrained joints shall be as specified in Appendix A (Approved Manufacturers List). No field welding of restrained joint pipe will be permitted.
 - b. Restrained joint pipe (RJP) on supports shall have bolted joints and shall be specifically designed for clear spans of at least 36 feet.
 - c. Flanged joints shall meet the requirements of ANSI B16.1, Class 250.

6. Flexible, restrained joint pipe shall be minimum Class 350. Joints shall be ball and socket type providing restraint and leaktight connections for up to 15 degrees of joint deflection. Flexible, restrained joint pipe shall be as specified. Appropriate transition pieces shall be utilized on each end of run of flexible joint pipe. All joint material required for proper installation shall be furnished by the pipe manufacturer.
7. Provide the appropriate gaskets for mechanical and flange joints. Gaskets for flange joints shall be made of 1/8-inch thick, cloth reinforced rubber; gaskets may be ring type or full-face type.
8. Provide the necessary bolts for mechanical, restrained and flange connections. Bolts for flange connections shall be steel with American Regular unfinished hexagon heads. Nuts shall be steel with American Standard Regular hexagonal dimensions, all as specified in ANSI B17.2. All bolts and all nuts shall be threaded in accordance with ANSI B1.1, Coarse Thread Series, Class 2A and 2B fit. Mechanical joint glands shall be ductile iron.
9. Ductile iron pipe shall be encased with polyethylene film only when shown on the Drawings. Polyethylene film shall have a minimum thickness of 8 mils and will be sealed as shown on the plans.
10. Pipe bosses shall be welded-on ductile iron body type and shall be faced and tapped for ANSI/AWWA C110/C21.10 flange connection. All welding, fabrication and outlet hole drilling shall be performed by the pipe manufacturer only. Outlets shall be free of burrs. Sizes shall be as indicated on the Drawings. The bosses shall be welded on minimum Class 51 ductile iron pipe.
11. Thrust collars shall be welded-on ductile iron body type designed to withstand thrust due to 350 psi internal pressure on a dead end.
12. Acceptance will be on the basis of the Engineer's inspection and the manufacturer's written certification that the pipe was manufactured and tested in accordance with the applicable standards.
13. Detection tape and wire shall be provided over all water mains as shown in standard detail drawings. Detection tape shall be installed a minimum of 2-feet above main. All tracer wire shall be attached to main using 250-lb zip ties. It shall be the responsibility of the contractor to ensure the integrity of tracer wire throughout the duration of the installation.
14. Locator wire posts shall be installed at a minimum of every 1000-feet or as indicated by engineer as shown in standard detail drawings.

B. Polyvinyl Chloride Pipe (PVC)

1. All PVC pipe 12-inches in diameter or less shall have belled ends for push-on type jointing and shall conform to AWWA C900, ductile iron pipe equivalent outside diameters. The pipe shall have a Dimension Ratio (DR) of 18 and shall be capable of withstanding a working pressure of 250 psi. Pipe shall be supplied in lengths of approximately 20 feet.
2. PVC pipe greater than 12-inches shall conform to AWWA C905.
3. All PVC pipe manufacturers must provide third party inspection certification as to their compliance with this pipe specification.
4. All fittings shall be ductile iron meeting the requirements of AWWA C153 with a minimum rated working pressure of 250psi. Fittings shall be cement lined in accordance with AWWA C104. Fittings shall be furnished with a bituminous outside coating. Special adapters shall be provided, as recommended by the manufacturer, to adapt the PVC pipe to mechanical jointing with cast or ductile iron pipe, fittings or valves.
5. Detection tape and wire shall be provided over all water mains as shown in standard detail drawings.
6. Acceptance will be on the basis of the Engineer's inspection and the manufacturer's written certification that the pipe was manufactured and tested in accordance with the applicable standards, including the National Sanitation Foundation. Additionally, each piece of pipe shall be stamped "NSF Approved".

D. Detection Tape: Detection tape shall be composed of a solid aluminum foil encased in a protective plastic jacket. Tapes shall be color coded in accordance with APWA color codes with the following legends: Water Systems, Safety Precaution Blue, "Caution Water Line Buried Below". Colors may be solid or striped. Tape shall be permanently printed with no surface printing allowed. Tape width shall be a minimum of 2-inches when buried less than 10-inches below the surface. Tape width shall be a minimum of 3-inches when buried greater than 10-inches and less than 20-inches. Detection tape shall be equal to Lineguard Type III Detectable or Allen Systems Detectatape.

E. Detection Wire: Shall be 12 AWG Copper Clad Steel (HMW-PE Insulated) as shown in standard detail drawings. Detection wire shall be attached to all new pipe installations and shall be bonded to ductile iron pipe. Detection wire connections shall be spliced together ensuring a pure metal to metal contact. All ends shall be terminated inside valve boxes with at least three (3) feet excess above grade for utility locating purposes.

2.03 Valves

A. Gate Valves (GV)

1. Gate valves 2-inches through 12-inches shall be resilient wedge type conforming to the requirements of AWWA C509 rated for 250 psi working pressure. No lead per NSF/ANSI 372, shall be made of cast iron or ductile iron body.
2. Valves shall be provided with two O-ring stem seals with one O-ring located above and one O-ring below the stem collar. The area between the O-rings shall be filled with lubricant to provide lubrication to the thrust collar bearing surfaces each time the valve is operated. At least one anti-friction washer shall be utilized to further minimize operating torque. All seals between valve parts, such as body and bonnet, bonnet and bonnet cover, shall be flat gaskets or O-rings.
3. The valve gate shall be made of cast iron having a vulcanized, synthetic rubber coating, or a seat ring attached to the disc with retaining screws. Sliding of the rubber on the seating surfaces to compress the rubber will not be allowed. The design shall be such that compression-set of the rubber shall not affect the ability of the valve to seal when pressure is applied to either side of the gate. The sealing mechanism shall provide zero leakage at the water working pressure when installed with the line flow in either direction.
4. All internal ferrous surfaces shall be coated with epoxy to a minimum thickness of 4 mils. The epoxy shall be non-toxic, impart no taste to the water and shall conform to AWWA C550, latest revision.
5. Gate valves 2 through 12-inches shall be as specified in Appendix A (Approved Manufacturers List) and shall be open left and equipped with 2-inch square operating nut.

B. Butterfly Valves (BV)

1. Butterfly valves shall be resilient seated, short body design, and shall be designed, manufactured, and tested in accordance with all requirements of AWWA C504 for Class 150B.
2. Valve bodies shall be ductile iron conforming to ASTM A 536, Grade 65-45-12 or ASTM A 126, Grade B cast iron. Shafts shall be ASTM A 276, Type 304 stainless steel, machined and polished. Valve discs shall be ductile iron, ASTM A 536, Grade 65-45-12 or ASTM A 126, Grade B cast iron. The resilient valve seat shall be located either on the valve disc or in the valve body and shall be fully field adjustable and field replaceable.
3. Valves shall be installed with the valve shafts horizontal. Valves and actuators shall have seals on all shafts and gaskets on valve actuator covers to prevent the entry of water. Actuator mounting brackets shall be totally enclosed and shall have gasket seals.

4. Actuators

- a. Valves shall be equipped with traveling nut, self-locking type actuators designed, manufactured and tested in accordance with AWWA C504. Actuators shall be capable of holding the disc in any position between full open and full closed without any movement or fluttering of the disc.
 - b. Actuators shall be furnished with fully adjustable mechanical stop-limiting devices. Actuators that utilize the sides of the actuator housing to limit disc travel are unacceptable.
 - c. Valve actuators shall be capable of withstanding a minimum of 450-foot pounds of input torque in either the open or closed position without damage.
5. Operators: Valves for buried service shall have a nut type operator and shall be equipped with a valve box and stem extension, as required.
6. Valve ends shall be mechanical joint type, except where flanged or restrained joint ends are shown. Flange joints shall meet the requirements of ANSI B16.1, Class 125.
7. Butterfly valves shall be as specified in Appendix A (Approved Manufacturers List).

2.04 Fire Hydrants

- A. All fire hydrants shall conform to the requirements of AWWA C502 for 250 psi working pressure. Hydrants shall be the compression type, closing with line pressure. The valve opening shall be 5-1/4" or 4-1/2 inches (as specified for each location), open left, federal safety yellow in color.
- B. In the event of a traffic accident, the hydrant barrel shall break away from the standpipe at a point above grade, break away flange, and in a manner which will prevent damage to the barrel and stem, preclude opening of the valve, and permit rapid and inexpensive restoration without digging or cutting off the water.
- C. The means for attaching the barrel to the standpipe shall permit facing the hydrant a minimum of eight different directions.
- D. Hydrants shall be fully bronze mounted with all working parts of bronze. Valve seat ring shall be bronze and shall screw into a bronze retainer.
- E. All working parts, including the seat ring shall be removable through the top without disturbing the barrel of the hydrant.

- F. The operating nut shall match those on the existing hydrants and open left. The operating threads shall be totally enclosed in an operating chamber, separated from the hydrant barrel by a rubber O-ring stem seal and lubricated by a grease or an oil reservoir.
- G. Hydrant shall be a non-freezing design and be provided with a simple, positive, and automatic drain which shall be fully closed whenever the main valve is opened. Drain holes must be free of debris or any obstruction.
- H. Hose and pumper connections shall be breech-locked, pinned, or threaded and pinned to seal them into the hydrant barrel. Each hydrant shall have two 2-1/2-inch hose connections and one 4-1/2-inch pumper connection, all with National Standard threads and each equipped with cap and non-kinking chain.
- I. Hydrants shall be furnished with a mechanical joint connection to the spigot of the 6-inch hydrant lead.
- J. Minimum depth of bury shall be 3 feet minimum. Provide extension section where necessary for proper vertical installation and in accordance with manufacturer's recommendations.
- K. All outside surfaces of the barrel above grade shall be painted with enamel equal to Koppers Glamortex 501 to match Federal Safety Yellow. Bonnett and cap shall be painted as directed. Operating nut shall not be painted.
- L. Hydrants shall be traffic model and shall be as specified in Appendix A (Approved Manufacturers List).

2.05 Valve Boxes and Extension Stems

- A. All valves shall be equipped with valve boxes. The valve boxes shall be cast iron two-piece screw type with drop covers. Valve boxes shall have a 5.25-inch inside diameter. Valve box covers shall weigh a minimum of 13 pounds. The valve boxes shall be adjustable to 6-inches up or down from the nominal required cover over the pipe. Valve boxes shall be of sufficient length that bottom flange of the lower belled portion of the box is below the valve operating nut. Ductile or cast iron extensions shall be provided as necessary. Covers shall have "WATER VALVE" or "WATER" cast into them.
- B. All valves greater than 4 feet deep shall be furnished with extension stems, as necessary, to bring the operating nut to within 30-inches of the top of the valve box. Connection to the valve shall be with a wrench nut coupling and a set screw to secure the coupling to the valve's operating nut. The coupling and square wrench nut shall be welded to the extension stem. Extension stems shall be equal to Mueller A-26441 or M & H Valve Style 3801.

2.06 Fiberglass Markers

The Contractor shall provide a fiberglass marker as detailed on the Drawings for each valve installed or every 1000 feet of pipe installed. Markers shall be equivalent to model listed in Approved Manufacturers List.

2.07 Tapping Sleeves and Valves

Installation of tapping sleeves will be site specific and shown on the approved plans. Tapping sleeves shall be made of 304 stainless steel and shall be equipped with a pressure test plug. The Contractor shall be responsible for determining the outside diameter of the pipe to be connected to prior to ordering the sleeve. Valves shall be gate valves furnished in accordance with the specifications shown above, with flanged connection to the tapping sleeve and mechanical joint connection to the branch pipe. The tapping sleeve shall be as specified in Appendix A (Approved Manufacturers List).

2.08 Tapping Saddles

Tapping saddles typically shall be ductile iron body type with NBR gasket and double stainless-steel straps. Saddle outside diameter range shall be designed solely for the pipe size that it will be installed. Connection shall be CC for $\frac{3}{4}$ " and 1" outlets and NPT for 1-1/2" and 2" outlets as detailed on the Drawings. Tapping saddles shall be as specified in Appendix A (Approved Manufacturers List).

2.09 Corporation Cocks and Curb Stops

Corporation cocks and curb stops shall be ground key type, shall be made of bronze conforming to ASTM B 61 or B 62, NSF/ANSI 372 (no lead requirements), and shall be suitable for the working pressure of the system. Ends shall be suitable for flared tube compression type joint. Threaded ends for inlet and outlet of corporation cocks shall conform to AWWA C800; coupling nut for connection to flared copper tubing shall conform to ANSI B16.26. Corporation cocks and curb stops shall be as specified in Appendix A (Approved Manufacturers List) and installed as indicated on the drawings.

2.10 Air Valves

- A. Air relief valves shall be provided in accordance with sound engineering practice at high points in water mains as required. Automatic air relief valves shall not be used in situations where flooding of the manhole or chamber may occur. The open end of an air relief pipe from automatic valves or from manually operated valve shall be extended to the top of the pit and provided with a screened downward facing elbow.
- B. Air Release Valve: The air release valve shall automatically release air accumulations from the pipeline due to the action of the float mechanism. When the air valve body fills with air, the float falls. Through the leverage mechanism, this causes the resilient seat to open the orifice and allow the air to escape to the atmosphere. When all the

air has been exhausted from the valve body, the float will be buoyed up. Through the leverage mechanism, this will cause the resilient seat to close the orifice, preventing water from being exhausted from the valve. The valve body shall be constructed of reinforced plastic. The float shall be constructed of foamed polypropylene. A resilient, Buna-N seat shall be installed for drop-tight closure. The air release valve shall have an isolating ball valve. Air release & vacuum valve may be specified in certain situations. In this case, the type and model will be specified.

- C. The Air Release Valve shall be as specified in Appendix A (Approved Manufacturers List).

2.11 Manholes and Precast Concrete Products

- A. Provide precast concrete products in accordance with the following:

- 1. Precast Concrete Sections

- a. Precast concrete sections shall meet the requirements of ASTM C 478. The minimum compressive strength of the concrete in precast sections shall be 4,000 psi. The minimum wall thickness shall be one-twelfth of the inside diameter of the base, riser or the largest cone diameter.
- b. Vaults shall be designed for HS20 live loads with the dimensions and thickness shown on the drawings.
- c. Transition slabs which convert bases larger than four feet in diameter to four-foot diameter risers shall be designed by the precast concrete manufacturer to carry the live and dead loads exerted on the slab.
- d. Seal joints between precast sections by means of rubber O-ring gaskets or flexible butyl rubber sealant. Butyl rubber sealants shall meet the requirements of AASHTO M-198. Sealant shall be pre-formed type with a minimum nominal diameter of 1-inch.
- e. Butyl rubber sealant shall be equal to Kent Seal No. 2 or Concrete Sealants CS 202.

- 2. Brick and Mortar: Brick shall be whole and hardburned, conforming to ASTM C 32 Grade MS. Mortar shall be made of one-part Portland cement and two parts clean sharp sand. Cement shall be Type 1 and shall conform to ASTM C 150. Sand shall meet ASTM C 53.

- 3. Iron Castings

- a. Cast iron manhole frames, covers and steps shall meet the requirements of ASTM A 48 for Class 30 gray iron and all applicable local standards. All castings shall be tough, close grained, smooth, and free from blow holes, blisters, shrinkage, strains, cracks, cold shots and other imperfections. No

- casting will be accepted which weighs less than 95 percent of the design weight. Shop drawings must indicate the design weight and provide sufficient dimensions to permit checking. All castings shall be thoroughly cleaned in the shop and given two coats of approved bituminous paint before rusting begins.
- b. Manhole frames and covers shall be manufactured by US Foundry or approved equal.
 - c. All frames and covers shall have machined horizontal bearing surfaces.
4. Plastic Steps: Manhole steps of polypropylene, molded around a steel rod, equal to products of M.A. Industries may be used.
5. Floor Door
- a. Door shall be single or double leaf type as shown on the Drawings.
 - b. The frame shall be 1/4-inch extruded aluminum alloy 6063-T6, with built-in neoprene cushion and with strap anchors bolted to the exterior. Door leaf shall be 1/4-inch aluminum diamond plate, alloy 6061-T6, reinforced with aluminum stiffeners as required. Stainless steel hinges shall be bolted to the underside and pivot on torsion bars that counterbalance the door for easy operation. The door shall open to 90 degrees and lock automatically in that position. A vinyl grip handle shall be provided to release the cover for closing. The door shall be built to withstand a live load of 300 pounds per square foot, and shall be equipped with a snap lock and removable handle. Bituminous coating shall be applied to exterior of frame by the manufacturer.
 - c. Floor Door shall be manufactured by Bilco, Halladay or approved equal.

2.12 Mechanical Joint Restraint

Mechanical joint restraint shall be provided at all mechanical joints, including fittings, valves, hydrants and other locations as shown on the Drawings. Mechanical joint restraint shall be as specified in Appendix A (Approved Manufacturers List). Thrust blocking shall be used only when approved by the Engineer. See standard detail drawing.

2.13 Hydrant Tees

Hydrant tees shall be as specified in approved drawings and as approved by the engineer.

2.14 Concrete

Concrete shall have a compressive strength of not less than 3000 psi, with not less than 5.5 bags of cement per cubic yard and a slump between 3 and 5-inches. For job mixed concrete, submit the concrete mix design for approval by the Engineer. Ready-mixed concrete shall be mixed and transported in accordance with ASTM C 94. Reinforcing steel shall conform to the requirements of ASTM A 615, Grade 60.

2.15 Automatic Flushing Devices

Automatic flushing devices shall be installed at all residential developments for every 25 lots/living units.

Part 3 Execution

3.01 Existing Utilities and Obstructions

- A. The Drawings indicate utilities or obstructions that are known to exist according to the best information available to the Owner. The Contractor shall call the Palmetto Utility Protection Service (811) as required by the South Carolina "Underground Utility Damage Prevention Act and all utilities, agencies or departments that own and/or operate utilities in the vicinity of the construction work site at least 72 hours (three business days) prior to construction to verify the location of the existing utilities.
- B. Existing Utility Location: The following steps shall be exercised to avoid interruption of existing utility service.
 - 1. Provide the required notice to the utility owners and allow them to locate their facilities according to South Carolina law. Field utility locations are valid for only 15 days after original notice. The Contractor shall ensure, at the time of any excavation, a valid utility location exists at the point of excavation.
 - 2. Expose the facility, for a distance of at least 200 feet in advance of pipeline construction, to verify its true location and grade. Repair, or have repaired, any damage to utilities resulting from locating or exposing their true location.
 - 3. Avoid utility damage and interruption by protection with means or methods recommended by the utility owner by adhering to a tolerance zone of 24 inches on each side of conflicting utility.
 - 4. Maintain a log identifying when phone calls were made, who was called, area for which utility relocation was requested and work order number issued, if any. The Contractor shall provide the Engineer an updated copy of the log bi-weekly, or more frequently if required.
 - 5. No mechanized machinery is to be used in excavation until the utility in conflict has been identified except in the case of removing concrete or asphalt.
- C. Conflict with Existing Utilities
 - 1. Horizontal Conflict: Horizontal conflict shall be defined as when the actual horizontal separation between a utility, main, or service and the proposed water main does not permit safe installation of the water main by the use of sheeting, shoring, tying-back, supporting, or temporarily suspending service of the parallel or crossing facility. The Contractor may change the proposed alignment of the water main to avoid horizontal conflicts if the new alignment remains within the available right-of-way or easement, complies with regulatory agency requirements and after a written request to and subsequent approval by the Engineer. Where such relocation of the water main is denied by the Engineer, the Contractor shall arrange to have the utility, main, or service relocated.

2. Vertical Conflict: Vertical conflict shall be defined as when the actual vertical separation between a utility, main, or service and the proposed water main does not permit the crossing without immediate or potential future damage to the utility, main, service, or the water main. The Contractor may change the proposed grade of the water main to avoid vertical conflicts if the changed grade maintains adequate cover and complies with regulatory agencies requirements after written request to and subsequent approval by the Engineer. Where such relocation of the water main is denied by the Engineer, the Contractor shall arrange to have the utility, main, or service relocated.
- D. Electronic Locator: Have available at all times an electronic pipe locator and a magnetic locator, in good working order, to aid in locating existing pipe lines or other obstructions.
- E. Water and Sewer Separation
1. Crossings: Water mains crossing sewers shall be laid to provide a minimum vertical separation of 18 inches between the outside of the water main and the outside of the sewer. This shall be the case whether the water main is either above or below the sewer line. Whenever possible, the water main shall be located above the sewer line. Where a new water main crosses a new sewer, a full length of pipe shall be used for both the water main and sewer line and the crossing shall be arranged so that the joints of each line will be as far as possible from the point of crossing and each other. Where a new water main crosses an existing sewer line, one full length of water pipe shall be located so both joints will be as far from the sewer line as possible. Where a water main crosses under a sewer, adequate structural support shall be provided for the sewer line to prevent damage to the water main. All water mains shall be ductile iron and properly wrapped in polyethylene per engineer specification.
 2. Special Conditions: When it is impossible to obtain the specified minimum separation distances an alternative design may be approved. Any alternative design shall:
 - a. maximize the distances between the water main and sewer line and the joints of each;
 - b. use materials which meet the requirements of SCDHEC Regulation R61-58.4(D)(1) for the sewer line; and,
 - c. allow enough distance to make repairs to one of the lines without damaging the other.
 3. There shall be at least 10-foot horizontal separation between water mains and sanitary sewer force mains. There shall be an 18" vertical separation at crossing.
 4. Potable water lines shall not be laid less than 25 feet horizontally from any portion of wastewater tile-field or spray field.

5. No water main shall pass through, or come in contact with, any part of a sanitary sewer manhole or a storm water junction box/catch basin.
- F. Water mains shall be located out of contaminated areas. Every effort shall be made to re-route water lines outside of any contaminated area. If a water line must be located within any contaminated area, only DIP with chemical resistant gaskets may be used and only after approval of the Engineer.

3.02 Construction along Highways, Streets and Roadways

- A. Install pipe lines and appurtenances along highways, streets and roadways in accordance with the applicable regulations of, and permits issued by, the South Carolina Department of Transportation (SCDOT), Anderson and Pickens County and the Powdersville Water District with reference to construction operations, safety, traffic control, road maintenance and repair.
- B. Traffic Control
 1. The Contractor shall provide erect and maintain all necessary barricades, suitable and sufficient lights and other traffic control devices; provide qualified flagmen where necessary to direct traffic; take all necessary precautions for the protection of the work and the safety of the public.
 2. Construction traffic control devices and their installation shall be in accordance with the current SCDOT Manual on Uniform Traffic Control Devices for Streets and Highways.
 3. Placement and removal of construction traffic control devices shall be coordinated with SCDOT, Anderson and Pickens County and the Powdersville Water District a minimum of 48 hours in advance of the activity.
 4. Placement of construction traffic control devices shall be scheduled ahead of associated construction activities. Construction time in street right-of-way shall be conducted to minimize the length of time traffic is disrupted. Construction traffic control devices shall be removed immediately following their useful purpose. Traffic control devices used intermittently, such as "Flagmen Ahead", shall be removed and replaced when needed.
 5. Existing traffic control devices within the construction work zone shall be protected from damage. Traffic control devices requiring temporary relocation shall be located as near as possible to their original vertical and horizontal locations. Original locations shall be measured from reference points and recorded in a log prior to relocation. Temporary locations shall provide the same visibility to affected traffic as the original location. Relocated traffic control devices shall be reinstalled in their original locations as soon as practical following construction.

6. Construction traffic control devices shall be maintained in good repair and shall be clean and visible to affected traffic for daytime and nighttime operation. Traffic control devices affected by the construction work zone shall be inspected daily.
7. Construction warning signs shall be black legend on an orange background. Regulatory signs shall be black legend on a white background. Construction sign panels shall meet the minimum reflective requirements of the SCDOT, Anderson and Pickens County and the Powdersville Water District. Sign panels shall be of durable materials capable of maintaining their color, reflective character and legibility during the period of construction.
8. Channelization devices shall be positioned preceding an obstruction at a taper length as required by the current SCDOT Manual on Uniform Traffic Control Devices for Streets and Highways, as appropriate for the speed limit at that location. Channelization devices shall be patrolled to ensure that they are maintained in the proper position throughout their period of use.

D. Construction Operations

1. Perform all work along highways, streets and roadways to minimize interference with traffic.
2. Stripping: Where the pipe line is laid along road right-of-way, strip and stockpile all sod, topsoil and other material suitable for right-of-way restoration. See engineer for best location of stockpile materials.
3. Trenching, Laying and Backfilling: Do not open the trench any further ahead of pipe laying operations than is necessary. Backfill and remove excess material immediately behind laying operations. Complete excavation and backfill for any portion of the trench in the same day.
4. Shaping: Reshape damaged slopes, side ditches, and ditch lines immediately after completing backfilling operations. Replace topsoil, sod and any other materials removed from shoulders.
5. Construction operations shall be limited to 400 feet along areas within SCDOT jurisdiction, including clean-up and utility exploration.

E. Excavated Materials: Do not place excavated material along highways, streets and roadways in a manner which obstructs traffic. Sweep all scattered excavated material off of the pavement in a timely manner. See engineer for best location of stockpile materials.

F. Drainage Structures: Keep all side ditches, culverts, cross drains, and other drainage structures clear of excavated material. Care shall be taken to provide positive drainage to avoid ponding or concentration of runoff.

- G. Landscaping Features: Landscaping features shall include, but are not necessarily limited to: fences; property corners; cultivated trees and shrubbery; manmade improvements; subdivision and other signs within the right-of-way and easement. The Contractor shall take extreme care in moving landscape features and promptly re-establishing these features.
- H. Maintaining Highways, Streets, Roadways and Driveways
 - 1. Maintain streets, highways, roadways and driveways in suitable condition for movement of traffic until completion and final acceptance of the Work.
 - 2. During the time period between pavement removal and completing permanent pavement replacement, maintain highways, streets and roadways by the use of steel running plates. Running plate edges shall have chamfered edges. The backfill above the pipe shall be compacted as specified elsewhere up to the existing pavement surface to provide support for the steel running plates.
 - 3. Immediately repair all driveways that are cut or damaged. Maintain them in a suitable condition for use until completion and final acceptance of the Work.

3.03 Pipe Distribution

- A. Pipe shall be distributed and placed in such a manner that will not interfere with traffic.
- B. No pipe shall be strung further along the route than 1,000 feet beyond the area in which the Contractor is actually working without written permission from the Owner. The Owner reserves the right to reduce this distance to a maximum distance of 200 feet in residential and commercial areas based on the effects of the distribution to the adjacent property owners.
- C. No street or roadway may be closed for unloading of pipe without first obtaining permission from the proper authorities. The Contractor shall furnish and maintain proper warning signs and obstruction lights for the protection of traffic along highways, streets and roadways upon which pipe is distributed.
- D. No distributed pipe shall block drainage ditches or driveways.
- E. Distributed pipe shall be placed as far as possible from the roadway pavement, but no closer than five feet from the roadway pavement, as measured edge-to-edge.

3.04 Location and Grade

- A. The Drawings show the alignment of the water main and the location of valves, hydrants and other appurtenances.
- B. Prior to clearing and grubbing, the Engineer will provide a temporary benchmark along the water main route and at all other locations where the alignment of the water main changes significantly.
- C. Construction Staking
 - 1. The base lines for locating the principal components of the work (pipe, hydrants, valves, etc.) and a benchmark adjacent to the work are shown on the Drawings. Base lines shall be defined as the line to which the location of the water main is referenced, i.e., edge of pavement, road centerline, property line, right-of-way or survey line. The Contractor shall be responsible for performing all survey work required for constructing the water main, including the establishment of base lines and any detail surveys needed for construction. This work shall include the staking out of permanent and temporary easements to ensure that the Contractor is not deviating from the designated easements.
 - 2. The level of detail of survey required shall be that which the correct location of the water main can be established for construction and verified by the Engineer. Where the location of components of the water main, e.g. road bores and fittings, are not dimensioned the Engineer shall be contacted.
- D. Reference Points
 - 1. The Contractor shall take all precautions necessary, which includes, but is not necessarily limited to, installing reference points, in order to protect and preserve the centerline or baseline established by the Engineer.
 - 2. If applicable, reference points shall be placed, at or no more than three feet, from the outside of the construction easement or right-of-way. The location of the reference points shall be recorded in a log with a copy provided to the Engineer for use, prior to verifying reference point locations. Distances between reference points and the manhole centerlines shall be accurately measured to 0.01 foot.
 - 3. The Contractor shall give the Engineer reasonable notice that reference points are set. The reference point locations must be verified by the Engineer prior to commencing clearing and grubbing operations.
- E. After the Contractor locates and marks the water main centerline or baseline, the Contractor shall perform clearing and grubbing.
- F. Construction shall begin at a connection location and proceed without interruption. Multiple construction sites shall not be permitted without written authorization from the Engineer for each site.

- G. The Contractor shall be responsible for any damage done to reference points, base lines, center lines and temporary benchmarks, and shall be responsible for the cost of re-establishment of reference points, base lines, center lines and temporary bench marks as a result of the operations.

3.05 Laying and Jointing Pipe and Accessories

- A. Lay all pipe and fittings to accurately conform to the lines and grades established by the Engineer.
- B. Pipe Installation
 - 1. Proper implements, tools and facilities shall be provided for the safe performance of the Work. All pipe, fittings, valves and hydrants shall be lowered carefully into the trench by means of slings, ropes or other suitable tools or equipment in such a manner as to prevent damage to water main materials and protective coatings and linings. Under no circumstances shall water main materials be dropped or dumped into the trench.
 - 2. All pipes, fittings, valves, hydrants and other appurtenances shall be examined carefully for damage and other defects immediately before installation. Defective materials shall be marked and held for inspection by the Engineer, who may prescribe corrective repairs or reject the materials.
 - 3. All lumps, blisters and excess coating shall be removed from the socket and plain ends of each pipe, and the outside of the plain end and the inside of the bell shall be wiped clean and dry and free from dirt, sand, grit or any foreign materials before the pipe is laid. No pipe containing dirt shall be laid.
 - 4. Foreign material shall be prevented from entering the pipe while it is being placed in the trench. No debris, tools, clothing or other materials shall be placed in the pipe at any time.
 - 5. As each length of pipe is placed in the trench, the joint shall be assembled and the pipe brought to correct line and grade. The pipe shall be secured in place with approved backfill material.
 - 6. It is not mandatory to lay pipe with the bells facing the direction in which work is progressing.
 - 7. Applying pressure to the pipe, such as pressing with a backhoe bucket, to lower the pipe to the proper elevation or grade, shall not be permitted.
 - 8. Detection tape shall be buried 4 to 10-inches deep. Should detection tape need to be installed deeper, the Contractor shall provide 3-inch wide tape. In no case shall detection tape be buried greater than 20-inches from the finish grade surface.

9. Detection wire shall be firmly taped to top of all pipe at intervals not to exceed 10 feet. The wire shall be continuous between appurtenances; and, a minimum of 36-inches shall be coiled in each appurtenance enclosure for easy attachment thereto of locator equipment. The wire shall be single conductor copper #12 AWG, or minimum, with 600v gasoline and oil resistant insulation.
10. Above-water crossings: The pipe shall be adequately supported and anchored, protected from damage and freezing, accessible for repair or replacement.
11. Underwater and culvert crossings: A minimum of 2 feet of cover shall be provided over the pipe. When crossing water courses that are greater than 15 feet in width, the following shall be provided:
 - a. The pipe material shall be ductile iron pipe with restrained joints.
 - b. Valves shall be located so the pipe crossing section can be isolated for testing or repair; the valves (on both sides of crossing) shall be easily accessible and not subject to flooding.
 - c. A blow-off shall be provided on the side opposite the supply service sized in accordance with SCDHEC Regulation R.61-58.4.(D)(7). The blow-off shall be directed away from streams, over ground.
 - d. Use DIP with mechanical joints or restrained joints for each joint for any lines crossing bodies of water.
12. Cross Connection Control (Backflow Prevention Devices):
 - a. There shall be no connection between the distribution system and any pipes, pumps, hydrants, or tanks whereby unsafe water or other foreign materials may be discharged or drawn into the system. See PWD's approved Cross-Connection Control Policy.
 - b. No by-passes shall be allowed, unless the bypass is also equipped with an equal, approved back-flow prevention device. Reference standard detail drawings for back-flow devices in Appendix A.
 - c. High hazard category cross connections shall require an air gap separation or an approved reduced pressure backflow preventor.
 - d. Reduced pressure principal backflow prevention assemblies shall not be installed in any area location subject to possible flooding. This includes pits or vaults which are not provided with a gravity drain to the ground's surface that is capable of exceeding the discharge rate of the relief valve. Unless otherwise approve by the Engineer, if installed in a pit, the positive drain line shall be 2 times the size of the line entering the backflow prevention device. The drain cannot empty into any type of ditch, storm drain, or sewer, which could flood water back into the pit.

- e. All piping up to the inlet of the backflow prevention device must be suitable for potable water. The pipe must be AWWA or NSF approved. Black steel pipe cannot be used on the inlet side of the device.
- f. Fire line sprinkler systems and dedicated fire lines, except those in the high hazard category, shall be protected as directed by the engineer.

C. Alignment and Gradient

- 1. Lay pipe straight in alignment and gradient or follow true curves as nearly as practicable. Do not deflect any joint more than the maximum deflection recommended by the manufacturer. Provide bell holes to reduce axial deflection.
- 2. Maintain a transit, level and accessories on the job to lay out angles and ensure that deflection allowances are not exceeded.

D. Expediting of Work: Excavate, lay the pipe, and backfill as closely together as possible. Do not leave unjointed pipe in the trench overnight. Backfill and compact the trench as soon as possible after laying and jointing is completed. Cover the exposed end of the installed pipe each day at the close of work and at all other times when work is not in progress. If necessary to backfill over the end of an uncompleted pipe or accessory, close the end with a suitable plug, either push-on, mechanical joint, restrained joint or as approved by the Engineer.

E. Pipe Assembly:

- 1. Assembly is made by sliding the lubricated spigot end into the gasketed bell end. The gasket seals the joint against leaks, into or out of the pipeline.
- 2. Clean dirt and foreign material from the gasketed socket and the spigot end. Uniformly, apply furnished lubricant to the spigot end of the pipe up to the reference mark and to the gasket surface which makes contact with the spigot end of the pipe. Approved pipe lubricants listed in Appendix A.
- 3. Insert the spigot end into the socket so that it is near contact with the gasket. Keep the pipe lengths in proper alignment. Brace the bell while the spigot end is pushed through the gasket so that previously completed joints in the line will not be "stacked", "over-belled", or inserted past the referenced mark. Push the spigot end in until the referenced mark on the spigot end is flush with the end of the pipe. Some joints may require barring to seat the joint. If so, use a wood block to protect the end of the pipe. A come-a-long may be preferred to the bar and block, but a swinging stab is not recommended. Where the physical weight or trench conditions make the recommended methods unsafe, joints may be assembled using mechanical equipment provided that the pipe is properly lubed and aligned. The end must be protected from damage, and the joint must not be "over-belled" or inserted beyond the insert reference mark.

4. Push-on, mechanical, flange and restrained type joints shall be assembled in accordance with the manufacturer's recommendations.
 5. The Contractor shall inspect each pipe joint on either side of main line valves to ensure 100 percent seating of the pipe spigot, except as noted otherwise.
 6. Each restrained joint shall be inspected by the Contractor to ensure that it has been "homed" 100 percent, but not past the insertion line or the spigot end of the pipe.
 7. The Contractor shall internally inspect each pipe joint to ensure proper assembly for pipe 24-inches in diameter and larger after the pipe has been brought to final alignment.
- F. Cutting Pipe: Cut ductile iron or PVC pipe using an abrasive wheel saw and bevel the ends. Cut PVC pipe using a suitable saw; remove all burrs and smooth the end before jointing. The Contractor shall cut the pipe and bevel the end, as necessary, to provide the correct length of pipe necessary for installing the fittings, valves, accessories and closure pieces in the correct location. Only push-on or mechanical joint pipe shall be cut.
- G. Valve and Fitting Installation
1. Prior to installation, valves shall be inspected for direction of opening, number of turns to open, freedom of operation, tightness of pressure-containing bolting and test plugs, cleanliness of valve ports and especially seating surfaces, handling damage and cracks. Defective valves will not be accepted. Valves shall be closed before being installed.
 2. Valves, fittings, plugs and caps shall be set and joined to the pipe in the manner specified in this Section for cleaning, laying and joining pipe, except that 12-inch and larger valves shall be provided with special support, such as treated timbers, crushed stone, concrete pads or a sufficiently tamped trench bottom so that the pipe will not be required to support the weight of the valve. Valves shall be installed in the closed position.
 3. A valve box shall be provided on each underground valve. They shall be carefully set, centered exactly over the operating nut and truly plumbed. The valve box shall not transmit shock or stress to the valve. The bottom flange of the lower belled portion of the box shall be placed below the valve operating nut. This flange shall be set on brick, so arranged that the weight of the valve box and superimposed loads will bear on the base and not on the valve or pipe. Extension stems shall be installed where depth of bury places the operating nut in excess of 30-inches beneath finished grade so as to set the top of the operating nut 30-inches below finished grade. The valve box cover shall be flush with the surface of the finished area or such other level as directed by the Engineer.

4. In no case shall valves be used to bring misaligned pipe into alignment during installation. Pipe shall be supported in such a manner as to prevent stress on the valve.
5. A valve marker shall be provided for each underground valve as specified by the Engineer. Unless otherwise detailed on the Drawings or directed by the Engineer, valve markers shall be installed 6-inches inside the right-of-way or easement.

H. Hydrant Installation

1. Prior to installation, inspect all hydrants for direction of opening, nozzle threading, operating nut and cap nut dimensions, tightness of pressure-containing bolting, cleanliness of inlet elbow, handling damage and cracks. Defective hydrants shall be corrected or held for inspection by the Engineer.
2. All hydrants shall stand plumb and shall have their nozzles parallel with or at right angles to the roadway, with pumper nozzle facing the roadway
3. Hydrants shall be set to the established grade, with the centerline of the lowest nozzle at least 20-inches above the finished grade.
4. Each hydrant shall be connected to the main with a 6-inch branch controlled by an independent 6-inch valve as shown in sketches as part of the guidelines. Drainage shall be provided at the base of the hydrant by placing coarse gravel or stone from the bottom of the trench to at least 6-inches above the drain port openings in the hydrant to a distance of 12-inches around the elbow.

I. Air Valve Vaults

1. Construct the vault as detailed on the Drawings. See Standard Detail Drawings.
2. The frame and cover shall be cast into the top slab or cone.

3.06 Connections to Water Mains

- A. Make connections to existing pipe lines with tapping saddles and valves, unless specifically shown otherwise on the Drawings.
- B. Location: Before laying pipe, locate the points of connection to existing water mains and uncover as necessary for the Engineer to confirm the nature of the connection to be made.
- C. Interruption of Services: Make connections to existing water mains only when system operations permit. Operate existing valves only with the specific authorization and direct supervision of the Owner.

D. Tapping Saddles and Tapping Sleeves

1. Holes in the new pipe shall be machine cut with new bits and cutter shells, either in the field or at the factory. No torch cutting of holes shall be permitted.
2. Prior to attaching the saddle or sleeve, the pipe shall be thoroughly cleaned, utilizing a brush and rag, as required.
3. Before performing field machine cut, the water tightness of any sleeve shall be pressure tested. No leakage shall be permitted for a period of five minutes.
4. After attaching the saddle or sleeve to an existing main, but prior to making the tap, the interior of the assembly shall be disinfected. All surfaces to be exposed to potable water shall be swabbed or sprayed with a one percent hypochlorite solution.

E. Connections Using Solid Sleeves: Where connections are shown on the Drawings using solid sleeves, the Contractor shall furnish materials and labor necessary to make the connection to the existing pipe line.

F. Connections Using Couplings: Where connections are shown on the Drawings using couplings, the Contractor shall furnish materials and labor necessary to make the connection to the existing pipe line, including all necessary cutting, plugging and backfill.

3.07 Thrust Restraint

A. Provide restraint at all points where excessive hydraulic thrust may develop as required by the Engineer.

B. Mechanical Joint Restraint: Provide mechanical joint restraint where shown on the Drawings and on fire hydrants and all associated fittings, valves and related piping as described in the Standard Detail Drawings. Mechanical joint restraint shall be installed in accordance with the manufacturer's recommendations. Mechanical joint restraints should be placed at every joint within a radius from the fitting or stress point as prescribed by the Engineer. The Contractor shall furnish a torque wrench to verify the torque on all set screws which do not have inherent torque indicators.

C. Harnessing

1. Provide harness rods only where specifically shown on the Drawings or directed by the Engineer.
2. Harness rods shall be manufactured in accordance with ASTM A 36 and shall have an allowable tensile stress of no less than 22,000 psi. Harness rods shall be hot dip galvanized or field coated with bitumastic before backfilling.

3. Where possible, harness rods shall be installed through the mechanical joint bolt holes. Where it is not possible, provide 90-degree bend eye bolts.
 4. Eye bolts shall be of the same diameter as specified in AWWA C111 for that pipe size. The eye shall be welded closed. Where eye bolts are used in conjunction with harness rods, an appropriate size washer shall be utilized with a nut on each end of the harness rod. Eye bolts shall be of the same material and coating as the harness rods.
- D. Hydrants: Hydrants shall be attached to the water main by the following method:
1. For ALL mains, the isolation valve shall be attached to the main by using approved restrained joints.

3.08 Inspection and Testing

A. Pressure and Leakage Test

1. All sections of the water main subject to internal pressure shall be pressure tested in accordance with AWWA C600. A section of main will be considered ready for testing after completion of all thrust restraint and backfilling.
2. Each segment of water main between main valves shall be tested individually.
3. Test Preparation
 - a. For water mains less than 24-inches in diameter, flush sections thoroughly at flow velocities, greater than 2.5 feet per second, adequate to remove debris from pipe and valve seats. For water mains 24-inches in diameter and larger, the main shall be carefully swept clean, and mopped if directed by the Engineer. Partially open valves to allow the water to flush the valve seat. Coordinate use of all potable water with the engineer.
 - b. Partially operate valves and hydrants to clean out seats.
 - c. Provide temporary blocking, bulkheads, flanges and plugs as necessary, to assure all new pipe, valves and appurtenances will be pressure tested.
 - d. Before applying test pressure, air shall be completely expelled from the pipeline and all appurtenances. Insert taps at highpoints to expel air as main is filled with water as necessary to supplement automatic air valves. Air valve taps shall be constructed as detailed on the Drawings. Air valve locations shall be specified by the Engineer.
 - e. Fill pipeline slowly with water. Provide a suitable pump with an accurate water meter (to account for water usage) to pump the line to the specified pressure.

- f. The differential pressure across a valve or hydrant shall equal the maximum possible, but not exceed the rated working pressure. Where necessary, provide temporary backpressure to meet the differential pressure restrictions.
 - g. Valves shall not be operated in either the opening or closing direction at differential pressures above the rated pressure.
- 4. Test Pressure: Test the pipeline at 1.5 times your working pressure or 200 psi, whichever is greater, measured at the highest point in elevation for at least two hours. Maintain the test pressure within 5 psi of the specified test pressure for the test duration. Should the pressure drop more than 5 psi at any time during the test period, the pressure shall be restored to the specified test pressure. Provide an accurate pressure gage with graduation not greater than 5 psi.
- 5. Leakage
 - a. Leakage shall be defined as the sum of the quantity of water that must be pumped into the test section, to maintain pressure within 5 psi of the specified test pressure for the test duration plus water required to return line to test pressure at the end of the test. Leakage shall be the total cumulative amount measured on a water meter.
 - b. The Owner assumes no responsibility for leakage occurring through existing valves.
- 6. Test Results: No test section shall be accepted if the leakage exceeds the limits determined by the following formula:
 - a. Ductile Iron

$$L = [SD(P)^{1/2}] \cdot 133,200$$

L = allowable leakage, in gallons per hour

S = length of pipe tested, in feet

D = nominal diameter of the pipe, in inches

P = average test pressure during the leakage test, in pounds per square inch (gauge)

As determined under Section 4 of ANSI/AWWA C600.

b. PVC

$$L = [ND (P)^{1/2}] 7,400$$

L = allowable leakage, in gallons per hour

N = number of joints in pipeline being tested, in feet

D = nominal diameter of the pipe, in inches

P = average test pressure during the leakage test, in pounds per square inch (gauge)

As determined under Section 4 of ANSI/AWWA C600.

- c. If the water main section being tested contains lengths of various pipe diameters, the allowable leakage shall be the sum of the computed leakage for each diameter. The leakage test shall be repeated until the test section is accepted. All visible leaks shall be repaired regardless of leakage test results.

7. Completion: After a pipeline section has been accepted, relieve test pressure. Record type, size and location of all outlets on record drawings.

3.09 Disinfecting Pipeline

- A. After successfully pressure testing each pipeline section, disinfect in accordance with AWWA C651 for the continuous-feed method and these Specifications.
- B. Specialty Contractor: Disinfection shall be performed by an approved contractor. Before disinfection is performed, the Contractor shall submit a written procedure to the engineer for approval before being permitted to proceed with the disinfection. This plan shall also include the steps to be taken for the neutralization of the chlorinated water.
- C. Chlorination
1. Apply chlorine solution introduced at a controlled continuous rate at one end of a main as water is withdrawn from the other end to achieve a concentration of at least 50 milligrams per liter (50 PPM) free chlorine in new line. Retain chlorinated water for 24 hours.
 2. Chlorine concentration shall be recorded at every outlet along the line at the beginning and end of the 24-hour period.
 3. After 24 hours, all samples of water shall contain at least 10 milligrams per liter free chlorine. Re-chlorinate if required results are not obtained on all samples.

- D. Disposal of Chlorinated Water: Reduce chlorine residual of disinfection water to less than one milligram per liter if discharged directly to a body of water or to less than two milligrams per liter if discharged onto the ground prior to disposal. Treat water with sulfur dioxide or other reducing chemicals to neutralize chlorine residual. Flush all lines until residual is equal to existing system.
- E. Bacteriological Testing:
 - 1. After final flushing and before the water main is placed in service, the Contractor shall collect samples from the line and have tested for bacteriological quality in accordance with the rules of the South Carolina Department of Health and Environmental Control (DHEC). The bacteriological samples shall be analyzed for total coliform. Testing shall be performed by a laboratory certified by the State of South Carolina. The number of sites depend on the amount of new construction but must include all dead-end lines, be representative of the water in the newly constructed mains, and shall be collected a minimum of every 1,200 linear feet.
 - 2. Two or more successive sets of samples, taken at 24-hour intervals, shall indicate bacteriologically satisfactory water and the results shall be submitted to the District Office of DHEC.
 - 3. Prior to sampling, the chlorine residual must be reduced to normal system residual levels or be non-detectable in those systems not chlorinating.
 - 4. The chlorine residual must also be measured and reported.
 - 5. If the membrane filter method of analysis is used for the coliform analysis, non-coliform growth must also be reported. If the non-coliform growth is greater than eighty (80) colonies per one hundred (100) milliliters, the sample result is invalid and must be repeated.
 - 6. Re-chlorinate lines until required results are obtained.

3.10 Protection and Restoration of Work Area

- A. General: Return all items and all areas disturbed, directly or indirectly by work under these Specifications, to their original condition or better, as quickly as possible after work is started.
 - 1. The Contractor shall plan, coordinate, and prosecute the work such that disruption to personal property and business is held to a practical minimum.
 - 2. All construction areas abutting lawns and yards of residential or commercial property shall be restored promptly. Backfilling of underground facilities, ditches, and disturbed areas shall be accomplished on a daily basis as work is completed. Finishing, dressing, and grassing shall be accomplished immediately thereafter, as a continuous operation within each area being

constructed and with emphasis placed on completing each individual yard or business frontage. Care shall be taken to provide positive drainage to avoid ponding or concentration of runoff.

3. Handwork, including raking and smoothing, shall be required to ensure that the removal of roots, sticks, rocks, and other debris is removed in order to provide a neat and pleasing appearance.
 4. The SCDOT's engineer shall be authorized to stop all work by the Contractor when restoration and cleanup are unsatisfactory and to require appropriate remedial measures.
- B. Man-Made Improvements: Protect, or remove and replace with the Engineer's approval, all fences, walkways, mail boxes, pipe lines, drain culverts, power and telephone lines and cables, property pins and other improvements that may be encountered in the Work.
- C. Cultivated Growth: Do not disturb cultivated trees or shrubbery unless approved by the Engineer. Any such trees or shrubbery which must be removed shall be heeled in and replanted under the direction of an experienced nurseryman.
- D. Cutting of Trees: Do not cut trees for the performance of the work except as absolutely necessary. Protect trees that remain in the vicinity of the work from damage from equipment. Do not store spoil from excavation against the trunks. Remove excavated material stored over the root system of trees within 30 days to allow proper natural watering of the root system. Repair any damaged tree over 3-inches in diameter, not to be removed, under the direction of an experienced nurseryman. All trees and brush that require removal shall be promptly and completely removed from the work area and disposed of by the Contractor. No stumps, wood piles, or trash piles will be permitted on the work site.
- E. Disposal of Rubbish: Dispose of all materials cleared and grubbed during the construction of the Project in accordance with the applicable codes and rules of the appropriate county, state and federal regulatory agencies.
- F. Swamps and Other Wetlands
1. The Contractor shall not construct permanent roadbeds, berms, drainage structures or any other structures which alter the original topographic features within the easement.
 2. All temporary construction or alterations to the original topography will incorporate measures to prevent erosion into the surrounding swamp or wetland. All areas within the easement shall be returned to their original topographic condition as soon as possible after work is completed in the area. All materials of construction and other non-native materials shall be disposed by the Contractor.

3. The Contractor shall provide temporary culverts or other drainage structures, as necessary, to permit the free migration of water between portions of a swamp, wetland or stream which may be temporarily divided by construction.
4. The Contractor shall not spread, discharge or dump any fuel oil, gasoline, pesticide, or any other pollutant to adjacent swamps or wetlands.

3.11 Abandoning Existing Water Mains

- A. General: Abandon in place all existing water main segments indicated on the Drawings to be abandoned. **Perform abandonment after the new water main has been placed in service and all water main services have been changed over to the new main.** Salvage for the Owner, existing fire hydrants, valve boxes, valve markers, and other materials indicated on the Drawings or located on water mains abandoned.
- B. Capping and Plugging: If required, disconnect by sawing or cutting and removing a segment of existing pipe where cutting and capping or plugging is shown on the Drawings or directed by the Engineer. Provide a watertight pipe cap or plug and concrete blocking for restraint to seal off existing mains indicated to remain in service. Seal ends of existing mains to be abandoned with a pipe cap or plug or with a masonry plug and minimum 6-inch cover of concrete on all sides around the end of the pipe. The Contractor shall be responsible for uncovering and verifying the size and material of the existing main to be capped or plugged.
- C. Salvaging Materials: Salvage existing fire hydrants, valve boxes, valve markers and other materials as indicated on the Drawings and deliver salvaged items in good condition to the Owner's storage yard. Coordinate delivery and placement of salvaged materials in advance with the Owner.
- D. Blow-Off Piping: Remove existing blow-off piping, located on segments of water mains to be abandoned, to a minimum of two feet below finished grade. Seal the end of remaining piping as specified above in paragraph B. Blow-off piping removed becomes the property of the Owner.
- E. Pavement Removal and Replacement: Perform any necessary pavement removal and replacement in accordance with the details on the Drawings and Section 02575 of these Specifications.

END OF SECTION

Part 1 General

1.01 Scope

- A. The work covered by this Section includes furnishing all materials and equipment, providing all required labor and installing water service connections and all appurtenant work according to these Specifications and/or to the Water Connection Detail as shown schematically on the Drawings.
- B. Water meters are not to be furnished nor installed. However, the water meter connection must be compatible with the water meters currently used by the Owner.

1.02 Locations

Locations shall be directed by the Engineer along the route of the water mains.

1.03 Service Compatibility

It is the intent of these Specifications that the water service connections shall duplicate those presently being provided by the Owner in order to be compatible with their service maintenance procedures.

1.04 Quality Control

All materials installed under this Section shall have the approval of the NSF for water services.

Part 2 Products

2.01 Materials and Construction

- A. Service Line
 - 1. Polyethylene (PE) Tubing: All $\frac{3}{4}$ " and 1" water service line shall be iron pipe size, PE4710, SDR 7 polyethylene tubing or exceeding the requirements of ASTM D 2239 and AWWA C901. Working pressure rating shall be minimum of 265 psi with minimum burst pressure of 800 psi at 73.4 degrees F. Pipe shall be blue in color.
 - 2. Polyvinyl Chloride Pipe (PVC)
 - a. Pipe 1-1/2 Inches to 2 Inches in diameter used to construct service lines shall have belled ends and shall conform to ASTM D 1785.

- b. All fittings shall be of the same material, strength and dimension as the pipe. Special adapters shall be provided as recommended by the manufacturer to adapt the PVC pipe to mechanical joints with cast or ductile iron pipe, fittings or valves.
- c. Acceptance will be on the basis of the Engineer's inspection and the manufacturer's written certification that the pipe was manufactured and tested in accordance with the applicable standards, including the National Sanitation Foundation. Additionally, each piece of pipe shall be stamped "NSF Approved".

B. Meter Box

- 1. High Density Polyethylene meter boxes shall be rectangular shaped.
- 2. Meter boxes shall have a polyethylene lid that is reinforced traffic grade. The lid must be adaptable for Automatic Metering Interface (AMI) transmitter that mounts through the lid.
- 3. Meter boxes shall be as specified in Appendix A (Approved Manufacturers List).

C. Valves and Accessories

- 1. Valves: 2" Gate valves shall resilient wedge type conforming to the requirements of AWWA C509 rated for a working pressure of 200 psi. Ends shall be threaded, complying with ANSI B2.1. Valve shall be provided with triple O-ring stuffing box (2 upper, 1 lower). The valve shall be provided with a 2-inch operating nut, open left. Gate Valves shall be as specified in Appendix A (Approved Manufacturers List)
- 2. Corporation Cocks and Curb Stops
 - a. For ¾" and 1" connections, corporation cocks and curb stops shall be ground key type, shall be made of bronze conforming to ASTM B61 or B62 and shall be suitable for 100 PSI working pressure. The inlet shall be AWWA/CC taper threaded and the outlet shall be flared for connection to IPS PE tubing. The corporation valve shall be manufactured and tested in accordance with AWWA C800. Corporation cocks and curb stops shall be as specified in Appendix A (Approved Manufacturers List).
 - b. For 2" connections, a resilient seat, iron bodied gate valve shall be used as specified
- 3. Service Saddle
 - a. 2" through 8" mains: Service saddles shall be double strap clamps if used on ductile iron pipe; double strap clamps if used on C-900 PVC mains. (See approved parts list in Appendix A). The outlet shall be AWWA/CC

tapered threaded for $\frac{3}{4}$ " and 1" services and NPT outlet threaded for 1 $\frac{1}{2}$ " and 2" services.

- b. Mains larger than 8": Service saddles shall have a ductile iron body with double stainless steel straps. The outlet shall be AWWA/CC tapered threaded for $\frac{3}{4}$ " and 1" connections and NPT threaded outlet for 1 $\frac{1}{2}$ " and 2" connections.
- c. Service saddles shall be as specified in Appendix A (Approved Manufacturers List).

D. Connections to Water Mains

- 1. Connections to ductile iron pipe water mains shall be made utilizing a service saddle, as detailed on the Drawings in full accordance with AWWA requirements. Pressure ratings shall be as required for the installatio

Part 3 Execution

3.01 Installation

A. Water Service Connections

- 1. Water service connections shall be installed to the centerline properties adjacent to the water transmission mains both to the same side of the roadway (Short Side Service) and to the opposite side of the roadway (Long Side Service) as directed by the Engineer.
- 2. Water service connections installed under roadway shall be pulled through a bored hole approximately equal in diameter to the external diameter of the service line. No casing will be required for $\frac{3}{4}$ " through 2" in diameter unless otherwise directed by SCDOT. Minimum cover under roadway shall be four feet. At other locations minimum cover shall be two feet.
- 3. Installation shall conform to the details for water service connections appearing schematically on the Drawings. Contractor shall provide any and all appurtenant work required to provide the intended water service connections.

B. Permanent Water Services

- 1. Each new service line shall be tapped into the main through a corporation stop, utilizing a service saddle, as detailed on the Drawings. A new service line shall be provided to the meter as shown on the Drawings.
- 2. A corporation cock shall be provided at the water main for each service line.
- 3. A copper setter and meter box shall be provided at each existing or future water meter location. A 1-inch PVC pipe shall be installed on the discharge side of the meter box to serve as a location marker. The pipe must protrude a minimum of 18-inches above finish grade and buried 18" below finish grade.

4. AMI clearance from the top of the incoming service line to the lid of the meter box shall have a minimum clearance of 9-inches.
 5. All new domestic service lines shall be 1-inch polyethylene tubing from the main to the meter box.
 6. The location of the service lines for new residential developments shall be the centerline of the property boundary adjacent to the road.
 7. A $\frac{3}{4}$ " PVC ball valve (shut off valve) and 10" turf box shall be installed on brass nipple behind meter setter and protruding underground from the discharge side of the meter box.
- C. Temporary Water Services: Temporary services shall consist of relocating an existing water meter to just outside the construction limits to clear proposed grading by the DOT Contractor. Temporary services shall include connecting the relocated meter to the existing or new water main as appropriate by means of a new service line and any additional depth service line installation required to clear proposed grading work.
- D. Relocation of Service Lines
1. Relocate the existing meter to the new right-of-way limits and reconnect to the house service. Existing meters already located at the new right-of-way limits will not need relocating.
 2. Before disconnecting the existing meter, the existing corporation in the main shall be closed. All existing meters and meter boxes shall be removed, if not already located at the right-of-way, reinstalled and reconnected as indicated on the Drawings.
 3. Existing service lines shall be field-located by the Contractor. The Contractor shall be responsible for locating existing water meters, relocating the meters and meter boxes as necessary, and determining the existing size service line to reconnect the meters to the new water mains. All service lines installed under existing pavement, including streets, driveways and sidewalks, shall be installed by boring.
 4. The Contractor shall be prepared to make emergency repairs to the water system, if necessary, due to damage by others working in the area. In conjunction with this requirement, the Contractor shall furnish and have available at all times, a tapping machine, for the purpose of making temporary water service taps or emergency repairs to damaged water services.
- E. Transfer of Service: Immediately before connecting to the relocated or existing meter, all service lines shall be flushed to remove any foreign matter. Water meter shall be installed after the service line is cleared. At no point in time are lines flushed through a meter. Any special fittings required in reconnecting the existing meter to the new service line, or the existing private service line, shall be provided by the Contractor. To minimize out of service time, the Contractor shall determine the connections to be

made and have all the required pipe and fittings on hand before shutting off the existing service. All service transfers shall be coordinated with PWD to minimize customer service interruptions. After completing the connection, the new corporation stop shall be opened and all visible leaks shall be repaired.

END OF SECTION

Part 1 General

1.01 Scope

- A. The work covered in this section includes furnishing all material and equipment, providing all required labor and installing fire line service connections and all appurtenances according to these specifications and/or fire line connection detail as shown schematically on the drawings.
- B. If movement of water is ever contemplated in a fire line connection for a purpose other than for actual firefighting (i.e., testing, etc.), the connection **must be protected with a UL approved meter acceptable to PW and an approved backflow prevention device that is testable**. These devices must also meet specifications outlined in these construction guidelines. All meters must be fully compatible with PW's AMI metering system. Movement of water through fire lines is unacceptable unless the water is being used for fire-fighting purposes. Otherwise, PW has no way of knowing how much water is being used, unless it is adequately metered.
- C. If movement of water in the fire line connection is contemplated only for actual firefighting, then the connection must be equipped with a double detector check valve assembly as shown in these construction guidelines. The detector meter must be fully compatible with PW's AMI metering system.

Very Important: If a fire line is installed with a detector meter and later shows usage over 100 gallons in one 30-day cycle, this will indicate that unauthorized usage has occurred, unless there is proof of a fire. If this occurs, the account owner will have only three options:

- 1. Correct the illegal usage in 30 days.
 - 2. Install a UL approved meter that meets PW specifications at the property line closest to PW's existing water main within 120 days (this can be very expensive).
 - 3. Terminate water service to the fire line account.
- All installations will be the financial responsibility of the owner.

1.02 Locations

Locations for all backflow preventers, fire department connections, meters, taps, valves and vaults associated with fire lines, must be approved by PW prior to installation. PW will require that all fire line backflow preventers be installed as close to an existing water main as possible in an effort to minimize the length of stagnant pipe that will be connected to the active distribution system. This distance will only be compromised when fire and domestic use is metered in tandem by UL approved equipment. All meters, backflow preventers and appurtenances must be installed in a location that are readily accessible to PW employees for operation, maintenance and testing purposes.

1.03 Service Compatibility

It is the intent of these specifications that fire line connections duplicate those presently being provided by the Owner in order to be compatible with service maintenance procedures. When actual model numbers have been specified, this has been done for direct compatibility reasons to support other systems currently used by PW.

1.04 Quality Control

All material installed under this section shall have the approval of the NSF (National Sanitation Foundation) for water service and UL (Underwriter's Laboratory) when specified.

Part 2 Products

2.01 Material and Construction

A. Fire Line Taps and Service Connection

All piping and appurtenances shall be approved by PW and conform to these construction specifications. Material choices may vary depending upon actual site conditions.

B. Concrete Vaults

All backflow prevention equipment and metering for fire lines 4-inch and larger must be housed in a pre-cast concrete vault "dog house style" with opening for service pipe to be grouted upon completion. The vaults will have no bottoms, but installed over 12-inches of #57 stone on compacted soil. Vaults shall be equipped with a dual aluminum hatch centered over vital equipment and aligned with plastic coated manhole steps for safe entry. Vault tops shall be properly sealed to vertical walls and set at a finish grade that allows for positive drainage away from the hatch opening. Vaults shall meet dimension and design specifications as shown in these construction specifications.

C. Testable Backflow Preventers

All devices used for protecting fire lines must:

1. Meet SCHEC's list of approved devices
2. Must be configured to allow for easy access and connection for approved testing equipment
3. Must be flanged and piped for future removal or replacement
4. Fire lines will typically be protected with a DDCVA (Double Detector Check Valve Assembly) and these devices may be installed below grade, but must allow for tester to kneel beside the device and attach testing equipment to the test cocks
5. Preferred brands are listed on SC DHEC's list of approved devices

D. Valves and Accessories

All gate valves shall be resilient wedge type (AWWA C509) with operating nut, open left. All piping and mechanical joint fittings in vaults shall be ductile iron rated at 200 psi, secured with retaining glands equivalent to EBAA iron mega-lug. All bolts shall be easily accessible.

E. UL (Underwriter's Lab) and FM (Factory Mutual) Approved Meters

All meters 4-inch through 10" used for fire line connections shall be a Sensus Omni F2 fire line meter equipped with an AMI electronic register and transmitter compatible with PW's existing system measuring in US gallons. This is the only meter that will be accepted for these purposes.

F. Connection to Water Mains

1. Connection to existing PW water mains shall be made by either cutting in an MJ tee and valve or by using an approved tapping sleeve. PW Operations Manager or Engineer shall determine this on a case-by-case basis.
2. All piping from the existing water main to the vault at the property line shall be ductile iron and restrained as shown in these construction guidelines.

G. Fire Line Design

All fire lines will be individually designed and specified by the engineer.

Part 3 Execution

1.01 Installation

Fire Line Service Connections

- A. Fire line meter and backflow prevention devices shall be installed at the agreed upon property line.
- B. Fire line service connections under roadways shall be installed through steel casing, jacked and bored properly under the road at SCDOT proper depth.
- C. Installation must conform to any approved schematic or drawing.

END OF SECTION

General -This section provides the list of approved manufacturers and equipment for use in the Poudersville Water system.

A. Box, Meter (plastic)

1. Blow Off Boxes
Mid State MSBCF-173018SL Solid Metal Lid
2. AMI service connections (1" tap)
Mid State MSBCF-132418SL
3. AMI service connections (3/4" tap)
Mid State MSBCF-111818SL
4. AMI service connections (2" tap)
 - a) Quazite Box, 30"x48"x24", Open bottom #QPG3048BA24
 - b) Quazite Lid, 30"x48" with PW Logo, #SP-HGPG30048W5033W

B. Corporation Stops

1. 1" Taps (AWWA/CC)
 - a) Mueller B25005N (insta-tite, IPS tubing)
 - b) Ford FB6004 w/ CO633G (grip nut, IPS tubing)
2. 2" Taps – Use R/S Iron Bodied Gate Valve as specified with IPS thread
 - a) Mueller A-2360 (Pack joint coupling for PVC-(JPVCXMIP)
 - b) Clow 6100
 - c) American 2500)

C. Service Line Couplings & Adaptors (for residential services only)

1. Service line adaptor: 1" PE to 3/4" IPT Setter
 - a) Mueller 15426 male-15456 female
 - b) Ford C16-34-U-NI

D. Ductile Iron Fittings (3" and above) (All domestic made)

1. DI (w/ exterior Bituminous Coating), AWWA C153 MJ Compact
 - a) US Pipe
 - b) American Pipe
 - c) Tyler
2. Hydrant Tee
 - a) American – A10180
 - b) U.S. Pipe – U592

3. Anchor Couplings
 - a) American – A10895
 - b) U.S. Pipe – U591
- E. Fire Hydrants
 1. Three-way Mueller Super Centurion 250 A421, MJ, Federal Safety Yellow, Open Left
 2. Three-way American MJ MARK 73-5 Federal Safety Yellow, Open Left
- F. Meters (3/4" & Larger) – Supplied by PWD
 1. 3/4" & 1" Taps – Sensus AMI iPerl with 520M MXU as specified by PW
 2. Taps 1 1/2" -4" – shall be equipped with a AMI meter as specified by PW
- G. Pipe
 1. Ductile Iron, Sizes 4" to 12" - CL 350 (see specification section)
 2. Ductile Iron, Larger than 12" – Determined by PW Engineer
 3. Ductile Iron, Size 3" – CL 54
 - a) US Pipe
 - b) American Pipe
 - c) McWane
 4. PVC, Potable Water (see specification section)
 - a) 4" through 10" - AWWA C900 DR 18 - CL 200
 - b) Larger than 10" – AWWA C905, DR 21- CL 200
 - i) Napco
 - ii) JM
 - iii) Diamond
 5. Service Lines
 - a) 3/4" & 1" services - PE4710, SDR 7 (Endot, Endopure, Light Blue are acceptable)
 - b) 1 1/2" & larger, per Engineer Specification
 6. Pipe Lubricant
 - a) Blue Lube or approved equivalent
 7. Tracer Wire
 - a) APCU-1201 or approved equivalent
- H. Gaskets
 1. Gaskets, Restrained Joint
 - a) American – LOK FAST, FLEX-RING or LOK-RING
 - b) U.S. Pipe – TR FLEX or LOK-TYTE
 - c) Clow – SUPER-LOCK
 - d) McWane Sure Stop 350 3"-16"

2. Gaskets, Flexible Restrained Joint
 - a) American – FLEX-LOK
 - b) U.S. Pipe – USIFLEX
 - c) Clow – F-141
 - d) EBAA – FLEX-TEND

*No transition gaskets over 10" allowed.
- I. Saddles, Service (2" thru 8" in size)
 1. $\frac{3}{4}$ " and 1" CC outlet
 - a) Ford S-70 (class 160, C900)
 - b) Mueller S-13000 (class 160, C900)
 2. 2" NPT outlet
 - a) Smith Blair 317 (class 160, C900, AC)
 - b) Smith Blair 313 (DI)
 - c) Ford FC 202 (class 160, C900, AC)
 - d) Romac 202S (class 160, C900, AC)
- J. Saddles, Service (larger than 8" in size)
 1. $\frac{3}{4}$ " and 1" cc outlet
 - a) Smith Blair 317(class 160, C900, AC)
 - b) Smith Blair 313 (DI)
 - c) Ford FC 202 (class 160, C900, AC)
 - d) Romac 202S (class 160, C900, AC)
 2. 2" NPT outlet (see note)
 - a) Smith Blair 317 (class 160, C900, AC)
 - b) Smith Blair 313 (DI)
 - c) Ford FC 202 (class 160, C900, AC)
 - d) Romac 202S (class 160, C900, AC)

Note: All saddles must be made to fit the exact OD of the pipe.
- K. Meter Setters (top loading dual check valve and angled locking valve)
 1. $\frac{3}{4}$ " Ford VBHC72-9W-MM-33
 2. 1" Mueller B2434R-6A (5/8 x $\frac{3}{4}$ x 9)
 3. AY McDonald
 - a) 1 $\frac{1}{2}$ " AY720R600WWFF666
 - b) 2" AY720R700WWFF7771562

Setter Restraints

1. Brass-Pack Joint 2" Male Pipe Thread x 2" PVC
 - a) Ford C87-77-NL
 - b) Mueller P-15428

Ductile Iron Adapters

1. Harco DI Male Adapter 80170-Knuckle Joint 60-1000-02
2. Infact-Foster Adaptor 6" & 8"

L. Tapping Sleeves

1. Fabricated stainless-steel w/ carbon steel flange outlet
 - a) Romac SST
 - b) Ford FAST

M. Valves

1. Air Release
 - a) ARI-S-050 (or as specified by Engineer)
2. Butterfly 12" and larger
 - a) Pratt/Mueller Lineseal III
 - b) Clow Series 4500
 - c) Dezurik AWWA C504
3. Gate
 - 2" thru 3" valve w/ NPT
 - a) Mueller
 - b) Clow 6100 Series
 - 4" to 12" valve (MJ)
 - a) Clow 6100 series
 - b) Mueller A-2360
 - c) American 2500 Series

N. Full Circle Clamps

1. ¾"-1" Smith Blair-Style 244
2. 2" Smith Blair - Style 261
3. 2" thru 12" Mueller 540 series

O. Casing Spacers & End Seals

1. Spacers
 - a) Cascade
 - b) Pipesel & Insulator, Inc.
 - c) APS Model CI
2. End Seals
 - a) APS Model AC
 - b) Cascade

P. Mechanical Joint Restraints

1. EBAA Iron – Megalug Series 1100 (DIP) and Series 2000 (PVC)
2. Romac – Grip Ring
3. Smith Blair Bell Lock
4. American-Fast Grip Gasket for DI
5. McWane Sure Stop 350 3"-16"
6. Pack Joint 2" MPT x 2" PVC, Brass
 - a) Ford C87-77-NL
 - b) Mueller P-15428
 - c) Harco 82170 Knuckle Restraint 60-100-02

Q. Pipe and Valve Markers (labels will be specified)

1. Rhino TriView TVTI72UB2
72" Blue with Black Cap (for Tracer Wire) or approved equivalent
2. CRM High Performance Utility Marker CRM 3-66-08 or approved equivalent

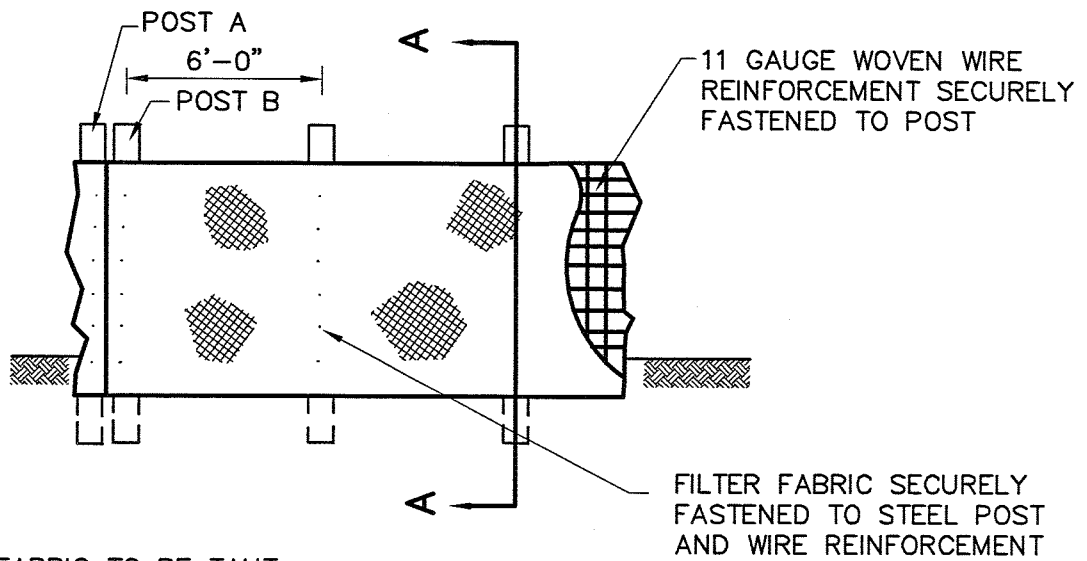
R. Automatic Flushing Devices

1. Hydro-guard-HG-1 Basic/S with Freeze Protection
2. Kupferle Eclipse 9700

S. Residential Shut-off Valves

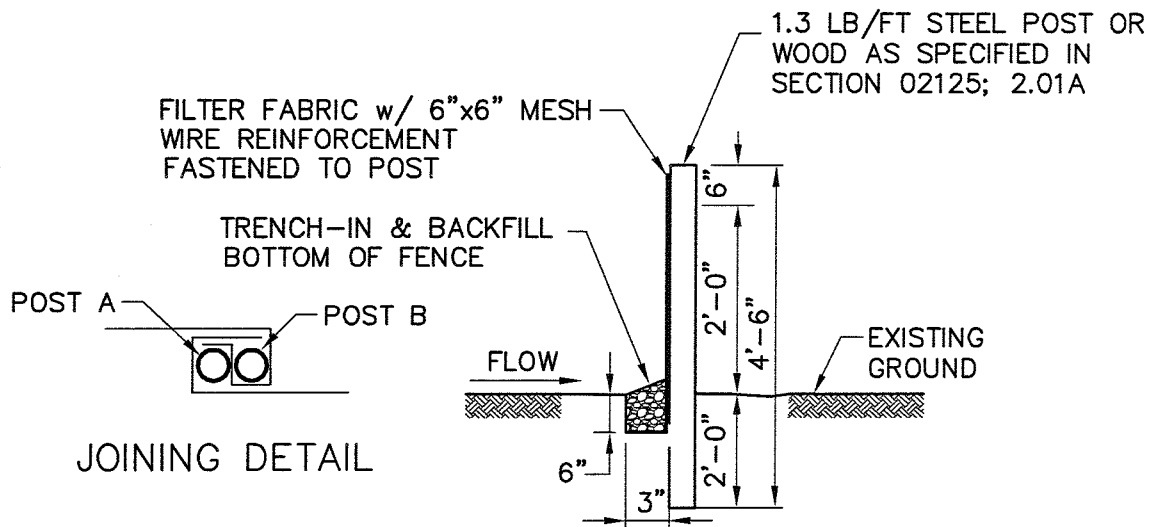
- a) ¾" American Granby PVC Ball Valve LP-94745
- b) 1" American Granby PVC Ball Valve LP-96990
- c) Turf Box-NDS 111BC 10" Round Box with Cover P/N: 59V111 BC or approved equivalent

END OF SECTION



*ADJUST FABRIC TO BE TAUT
OVER ALL UNEVEN SURFACES

ELEVATION



JOINING DETAIL

SECTION A-A



POWDERSVILLE WATER

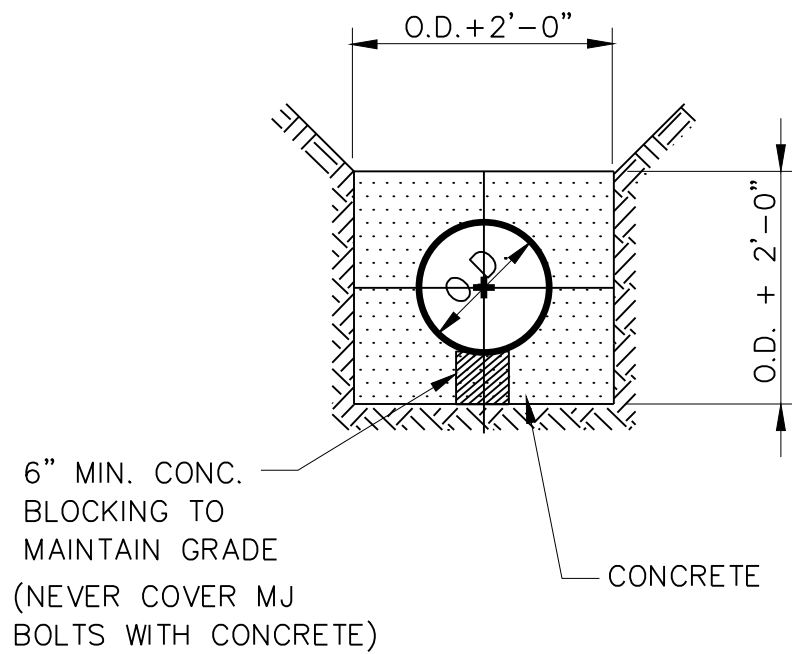
REINFORCED SILT FENCE
DETAIL

DATE : JUNE 2022

SCALE : N.T.S.

JOB NO.: 02400-001

SHEET STD-G-01



POWDERSVILLE WATER

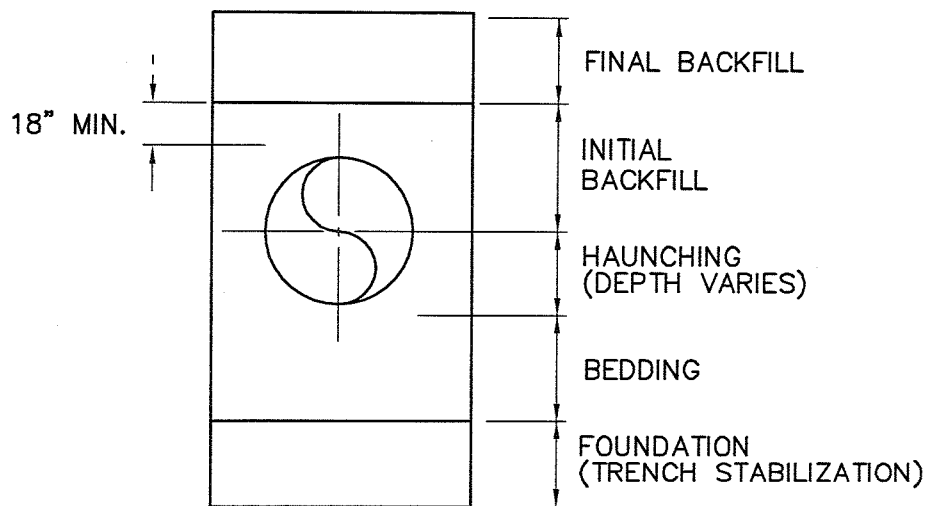
CONCRETE ENCASEMENT
DETAIL

DATE : JUNE 2022

SCALE : N.T.S.

JOB NO.: 02400-001

SHEET STD-G-02



NOTE: SEE SPECIFICATIONS AND PIPE
BEDDING AND HAUNCHING DETAILS
(SHT. STD-G-06)
FOR DIMENSIONS AND MATERIALS



POWDERSVILLE WATER

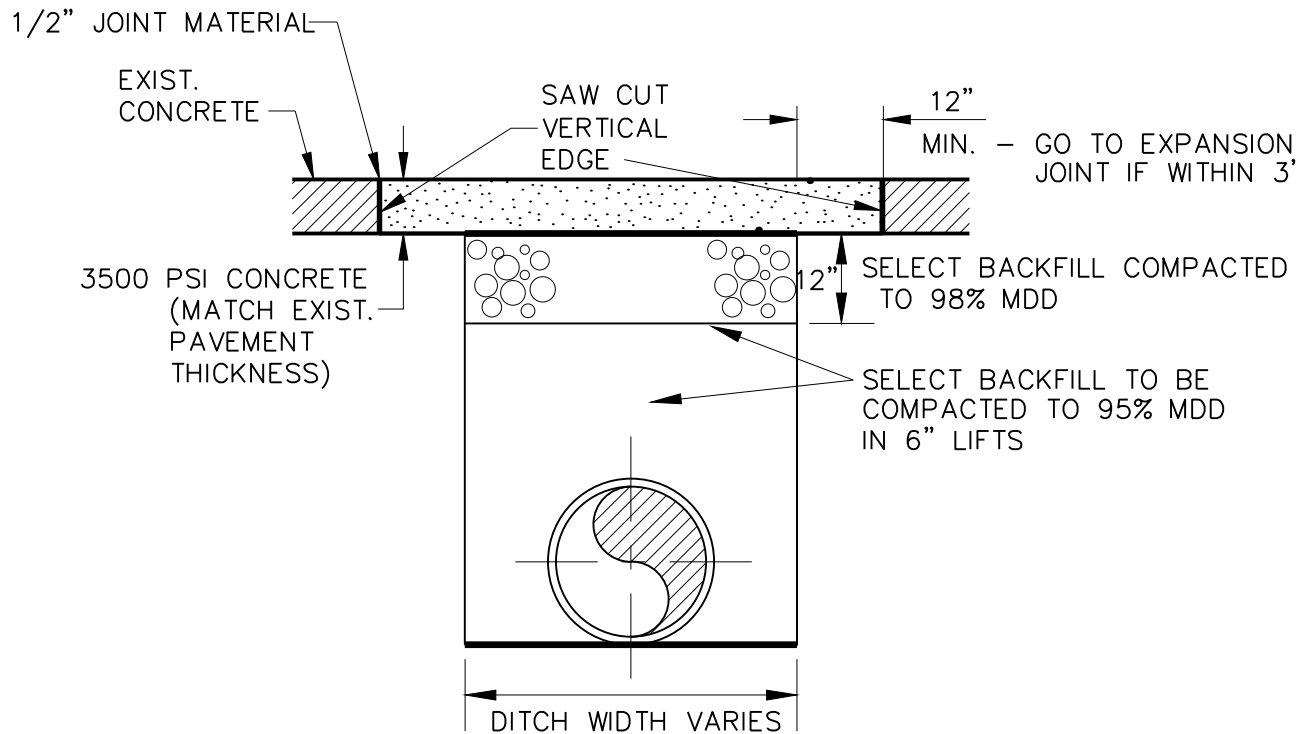
TRENCH TERMINOLOGY
DETAIL

DATE : JUNE 2022

SCALE : N.T.S.

JOB NO.: 02400-001

SHEET STD-G-03



POWDERSVILLE WATER

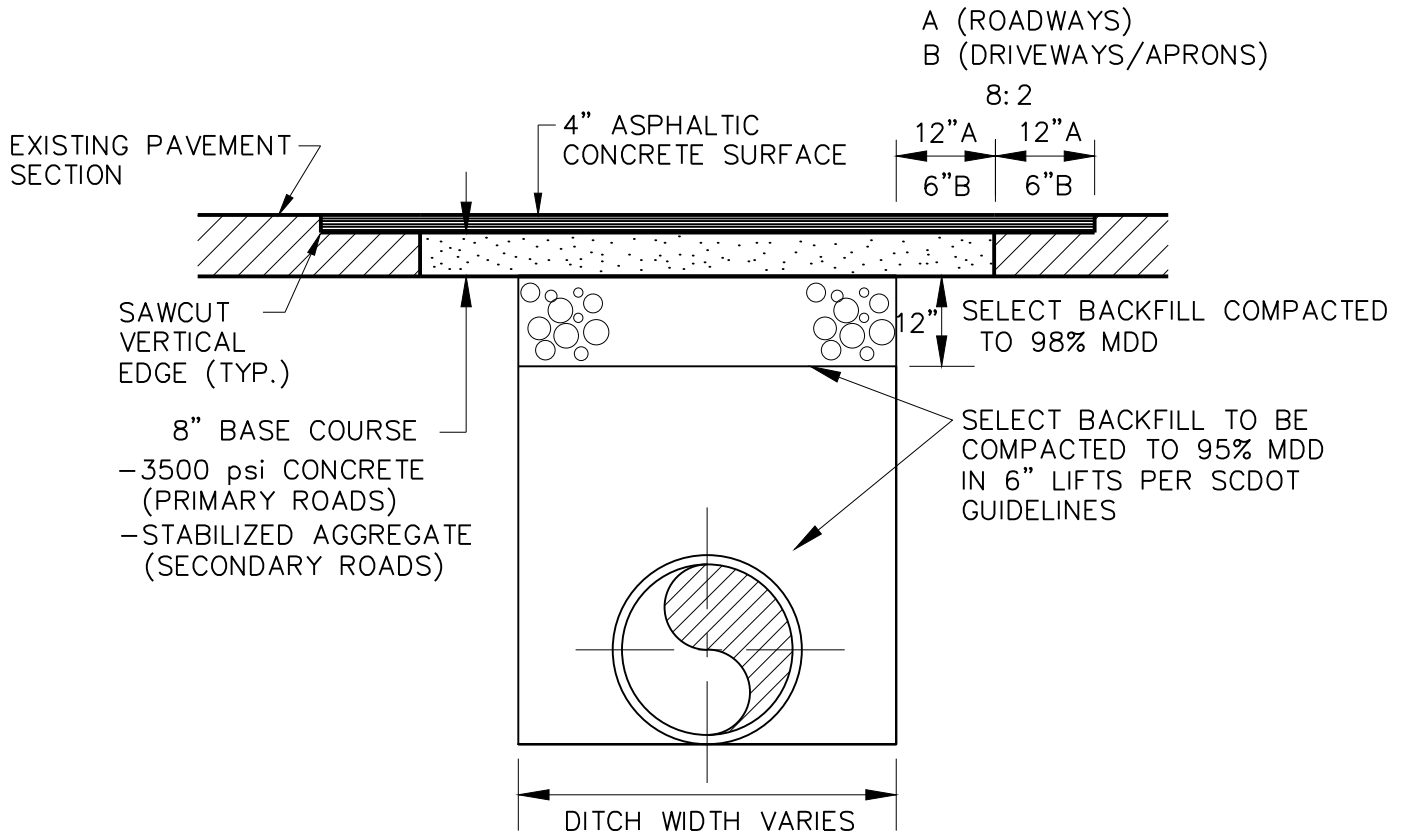
CONCRETE PAVEMENT
REPLACEMENT DETAIL

DATE : JUNE 2022

SCALE : N.T.S.

JOB NO.: 02400-001

SHEET STD-G-04



POWDERSVILLE WATER

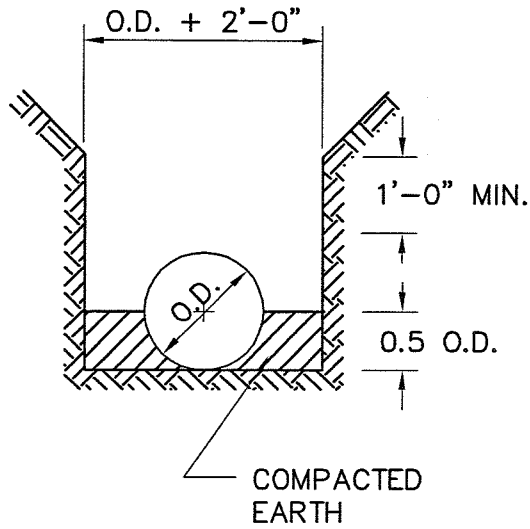
ASPHALT PAVEMENT
REPLACEMENT DETAIL

DATE : JUNE 2022

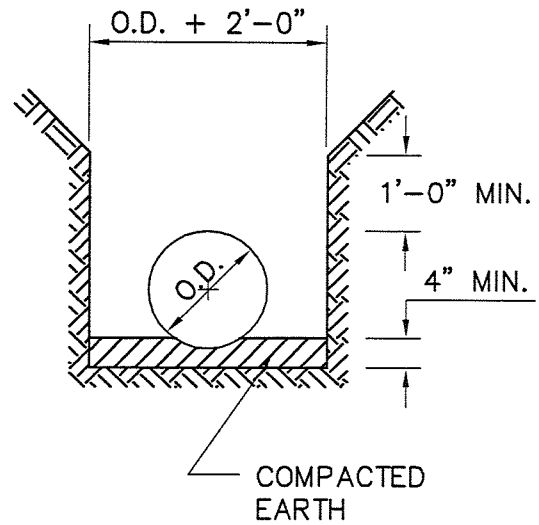
SCALE : N.T.S.

JOB NO.: 02400-001

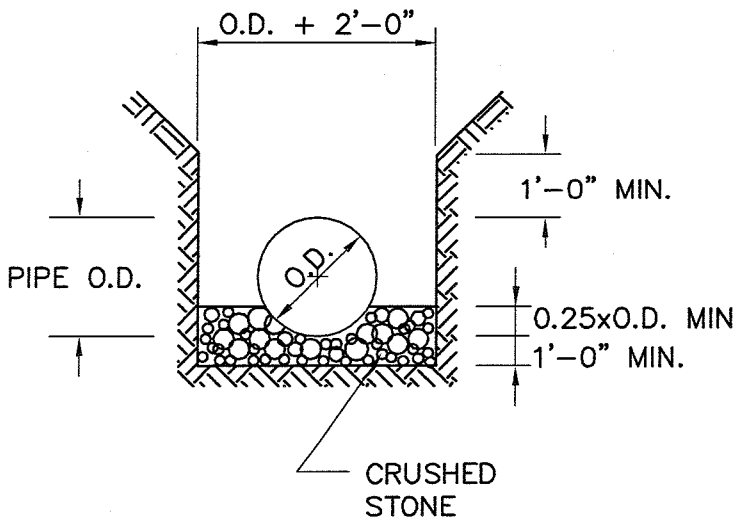
SHEET STD-G-05



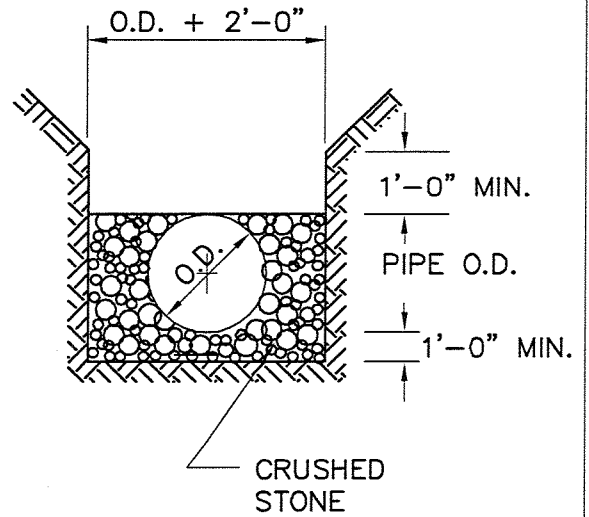
TYPE 2



TYPE 3



TYPE 4



TYPE 5



POWDERSVILLE WATER

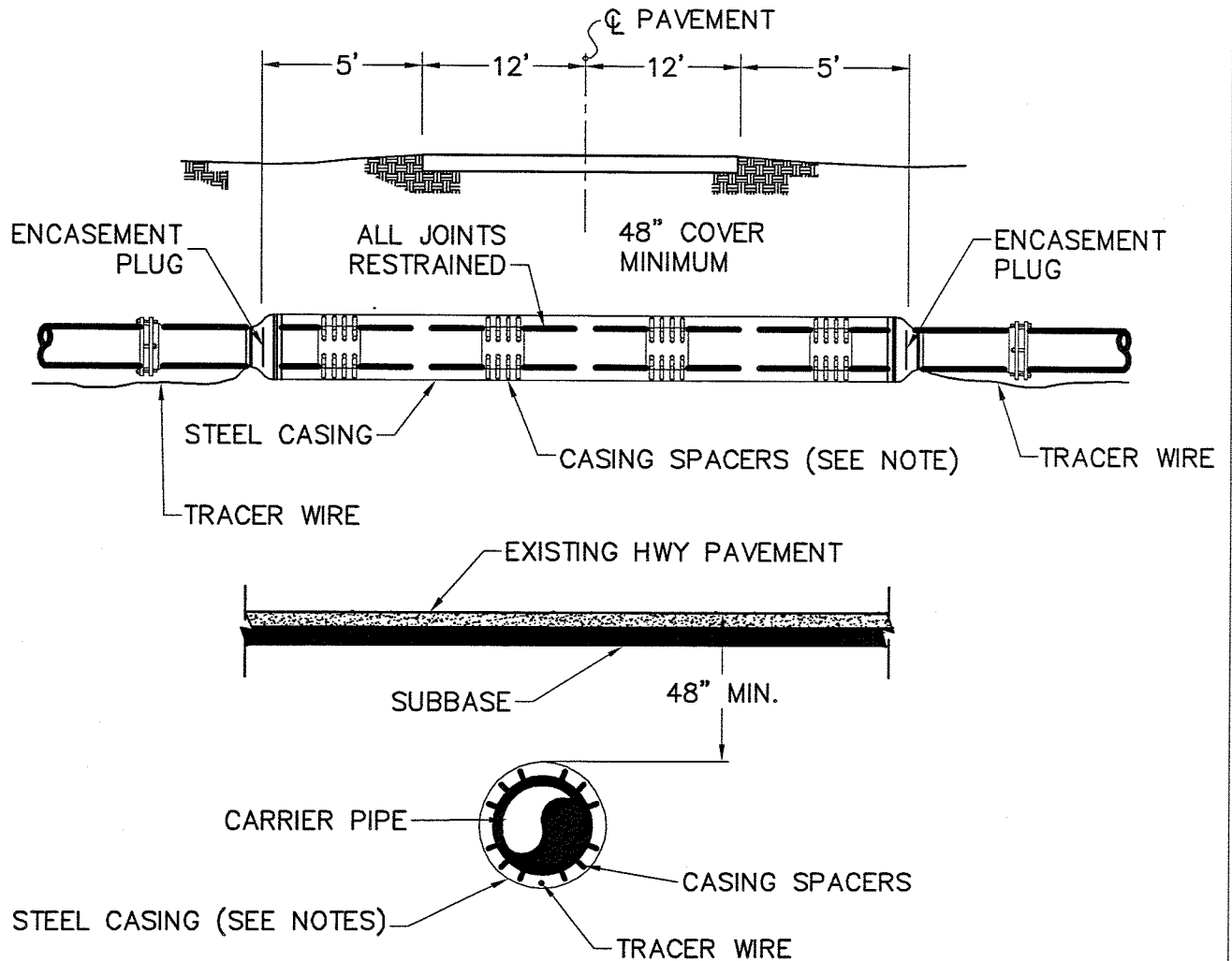
PIPE BEDDING AND HAUNCHING
DETAILS

DATE : JUNE 2022

SCALE : N.T.S.

JOB NO.: 02400-001

SHEET STD-G-06



NOTES:

- 1) STEEL CASING TO EXTEND 5' BEYOND EDGE OF PAVEMENT.
- 2) ALL CONSTRUCTION TO BE INSPECTED AND APPROVED BY LOCAL COUNTY OR STATE ROAD DEPARTMENT.
- 3) CONTRACTOR IS RESPONSIBLE FOR NOTIFICATION AND OBTAINING INSPECTION.
- 4) SIZE AND WALL THICKNESS OF CASING TO BE APPROVED BY PWD AND ROAD DEPARTMENT.
- 5) PLUG BOTH ENDS OF CASING WITH CASCADE CASING PLUGS.
- 6) CASING SPACERS SHALL BE ALL STAINLESS STEEL WITH PLASTIC SLIDES AS MADE BY CASCADE.
- 7) SPACING OF CASING SPACERS SHALL BE PER MANUFACTURERS SPECIFICATIONS BASED UPON CARRIER PIPE MATERIAL.



POWDERSVILLE WATER

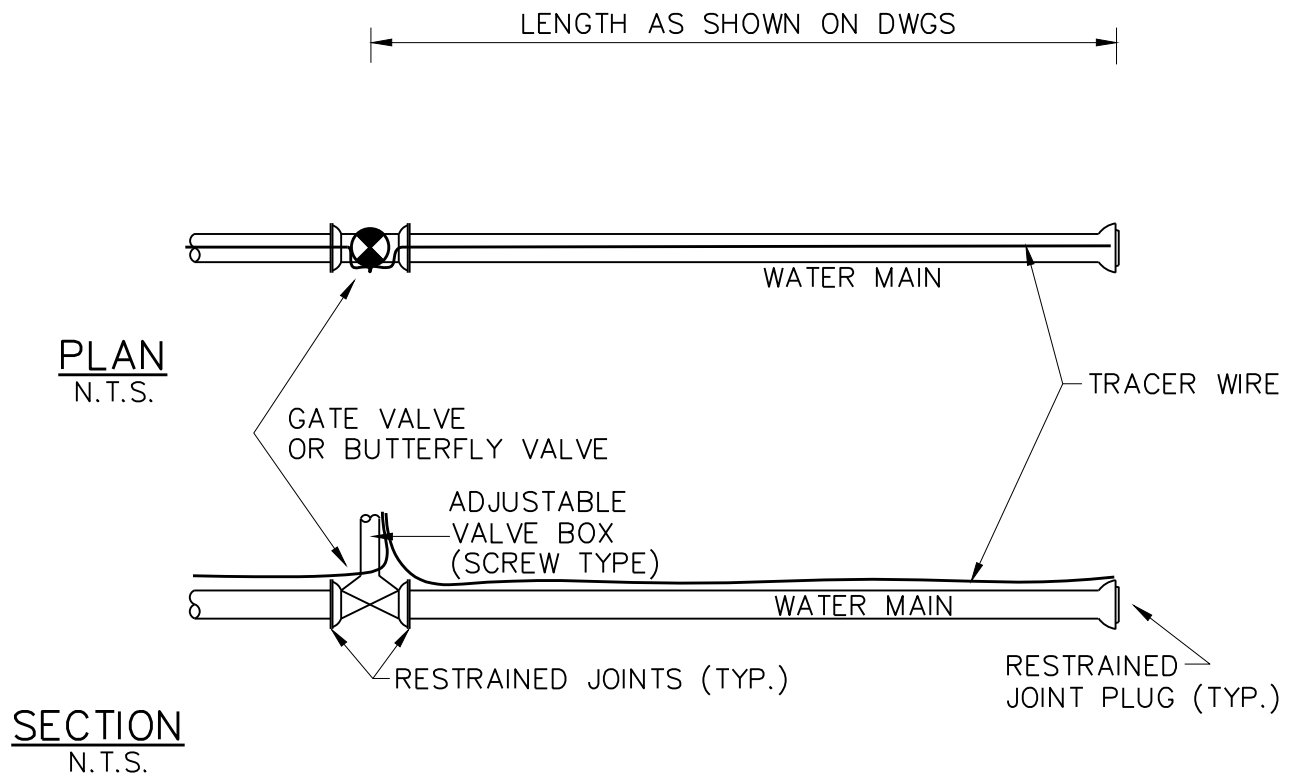
BORE AND JACK
DETAIL

DATE : JUNE 2022

SCALE : N.T.S

JOB NO.: 02400-001

SHEET STD-G-07



NOTE:
A MINIMUM OF TWO JOINTS
UPSTREAM OF THE VALVE
TO BE RESTRAINED JOINTS.
(AS SPECIFIED BY ENGINEER)



POWDERSVILLE WATER

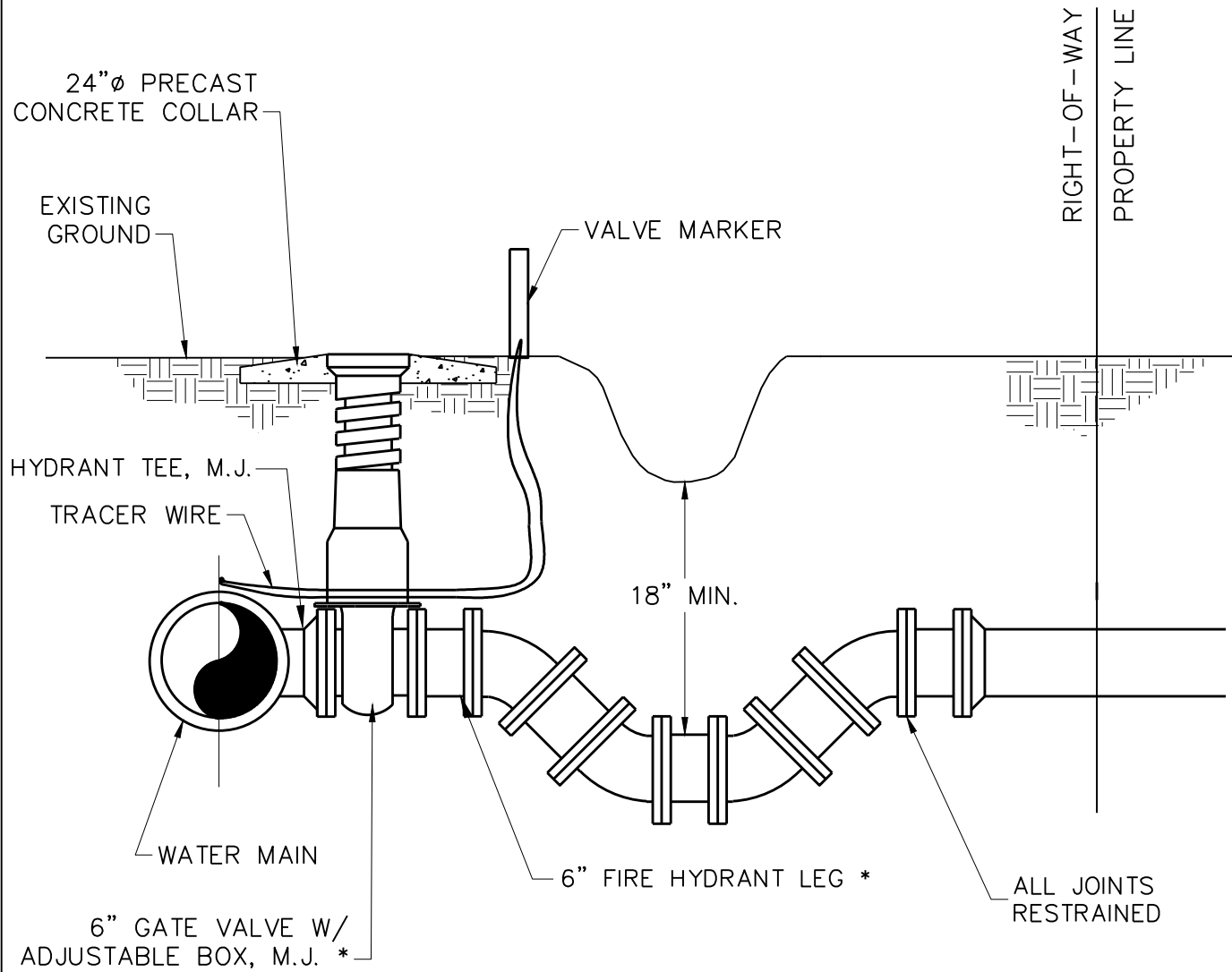
STUBOUT
DETAIL

DATE : JUNE 2022

SCALE : N.T.S.

JOB NO.: 02400-001

SHEET STD-G-08



* ACTUAL SIZE PER REQUEST



POWDERSVILLE WATER

STUB OUT UNDER DITCH
TO PROPERTY LINE DETAIL

DATE : JUNE 2022

SCALE : N.T.S

JOB NO.: 02400-001

SHEET STD-G-09



AGAVE WIRE, LTD

Toll-Free (800) 690-3408

ISO 9001:2000 Certified

Fax: (469) 547-4242

PRODUCT DATA SHEET

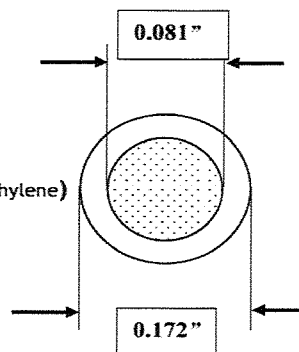
PRODUCT OVERVIEW:

APCU/APSU-1201 (Flexible CCS Tracer Wire)

CONSTRUCTION: One 12 AWG Copper Clad Steel HMW-PE Insulated Conductor
APPROVALS: UL - Tracer Wire
APPLICATION: Tracer Wire Suitable For Detecting Buried Facilities

CONSTRUCTION PARAMETERS:

CONDUCTOR: 12 AWG Copper Clad Steel
STRANDING: Solid
NUMBER OF CONDUCTORS: 1
INSULATION MATERIAL: HMW-PE (High Molecular Weight Polyethylene)
INSULATION THICKNESS: 0.045" Nominal (+/- .003 per UL)
COPPER O.D.: 0.081" Nominal
FINISHED O.D.: 0.172" Nominal
WEIGHT PER 1000ft: 24.97 lbs/1000'



ELECTRICAL & ENVIRONMENTAL PROPERTIES:

TEMPERATURE RATING: -20° c to 80° c
OPERATING VOLTAGE: 600v
INSULATION COLOR: Various Colors Available
BREAK LOAD: 282-299 LBS TENSILE STRENGTH: 55,000- 58,111 PSI

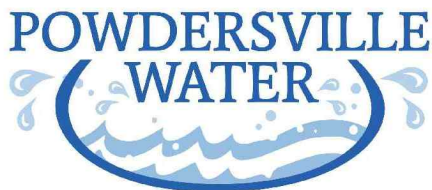
PRINT LEGEND:

AGAVE WIRE - 12AWG HMW-PE-(45) COPPER CLAD STEEL TRACER WIRE (UL) 600V E246360

On special orders, the customer will accept all mil lengths and +/- 10% of total order requested. The information presented here is, to the best of our knowledge, is true and accurate. However, since conditions of use are beyond our control, all recommendations or suggestions are presented without guarantee or responsibility on our part. We disclaim all liability in connection with the use of information contained herein or otherwise. This specification is proprietary intellectual property of Agave Wire. Any information contained herein shall not be disclosed to any party without written consent of Agave Wire.

Manufactured in the U.S.A.

P.O. Box 38409 · 10355 Sanden Drive · Dallas, TX 75238 · 214.503.2576 · Fax 469.547.4242 · www.agavewire.com



POWDERSVILLE WATER

DATE: JUNE 2022
SCALE: N.T.S.
JOB NO.:

AGAVE WIRE
APCU-1201 DETAIL

SHEET: STD-G-10

The diagram illustrates a manhole assembly with the following components and restraints:

- ROMAC GRIP RING RESTRAINTS (O.A.E.)**: Indicated by arrows pointing to the horizontal pipe sections.
- BELL RESTRAINT- PVC FIELD LOK GASKET- DUCTILE IRON (ONE JOINT)**: Indicated by an arrow pointing to the vertical pipe section.
- MJ TEE**: The central vertical pipe section.
- BELL RESTRAINT- PVC FIELD LOK GASKET- DUCTILE IRON (ONE JOINT)**: Indicated by an arrow pointing to the horizontal pipe section.
- MJ 90° ELL**: The horizontal pipe section.

ROMAC GRIP RING
RESTRAINTS (O.A.E.)

BELL RESTRAINT- PVC
FIELD LOK GASKET-
DUCTILE IRON
(ONE JOINT)

MJ 90° ELL

ROMAC GRIP RING
RESTRAINTS (O.A.E.)

BELL RESTRAINT- PVC
FIELD LOK GASKET-
DUCTILE IRON
(ONE JOINT)

MJ 45° ELL

BELL RESTRAINT- PVC
FIELD LOK GASKET-
DUCTILE IRON
(ONE JOINT)

ROMAC GRIP RING
RESTRAINTS (O.A.E.)

BELL RESTRAINT- PVC
FIELD LOK GASKET-
DUCTILE IRON
(ONE JOINT)

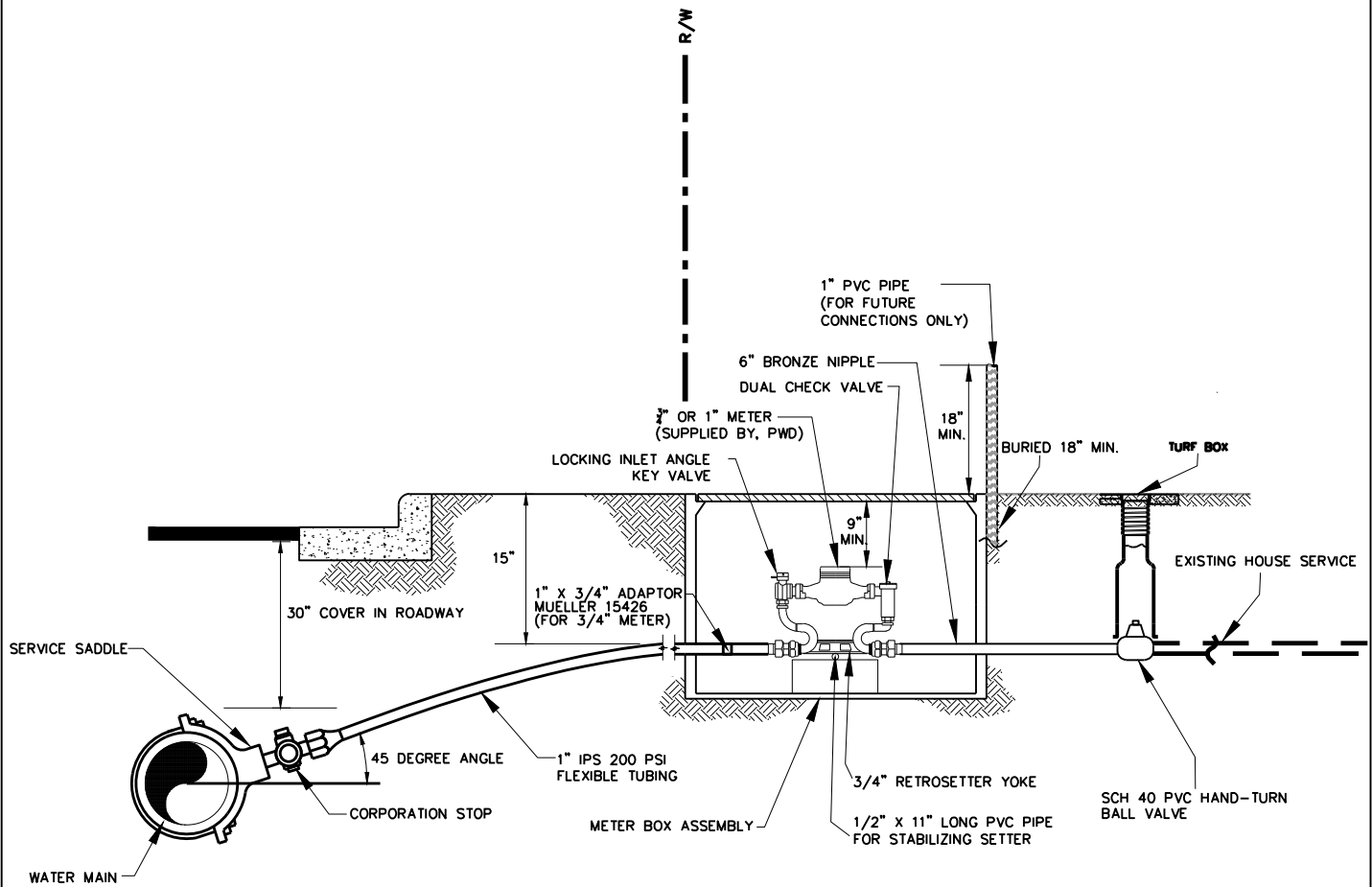
ALL JOINTS RESTRAINED
60' UNLESS SPECIFIED
BY ENGINEER

The logo for Powdersville Water features the words "POWDERSVILLE" and "WATER" in a blue, serif font. Below the text is a stylized blue wave graphic with small bubbles, all enclosed within a blue circular arc.

TYPICAL FITTING & JOINT RESTRAINT FOR 4" AND ABOVE PIPE SIZE

JOB NO.:

SHEET STD-G-11



Size	Corporation Stop	Meter Box	Meter	Tubing	Setter Box
3/4"	Mueller B25005N (Insta-tite, IPS tubing)	Mid State MSBCF-111818SL	Supplied by PWD	PE3408, SDR7, ASTM 2239, AWWA C901, IPS, BLUE	Ford VBHC72-9W-MM-33 or Mueller B2434R-6A (5/8x3/4x9)
1"	Ford FB6004 w/ C0633G (grip nut, IPS tubing)	Mid State MSBCF-132418SL	Supplied by PWD		

SERVICE SADDLES		Meter LID
Main	3/4" & 1" CC outlet	B9XBLKHDRPHD-3/4" NICOR LID
2" - 8"	Ford S-70 or Mueller S-13000	
>8"	Smith Blair 317, Ford FC 202 or Ronac 202S	B12XBLKHDRPHD-1" NICOR LID



POWDERSVILLE WATER

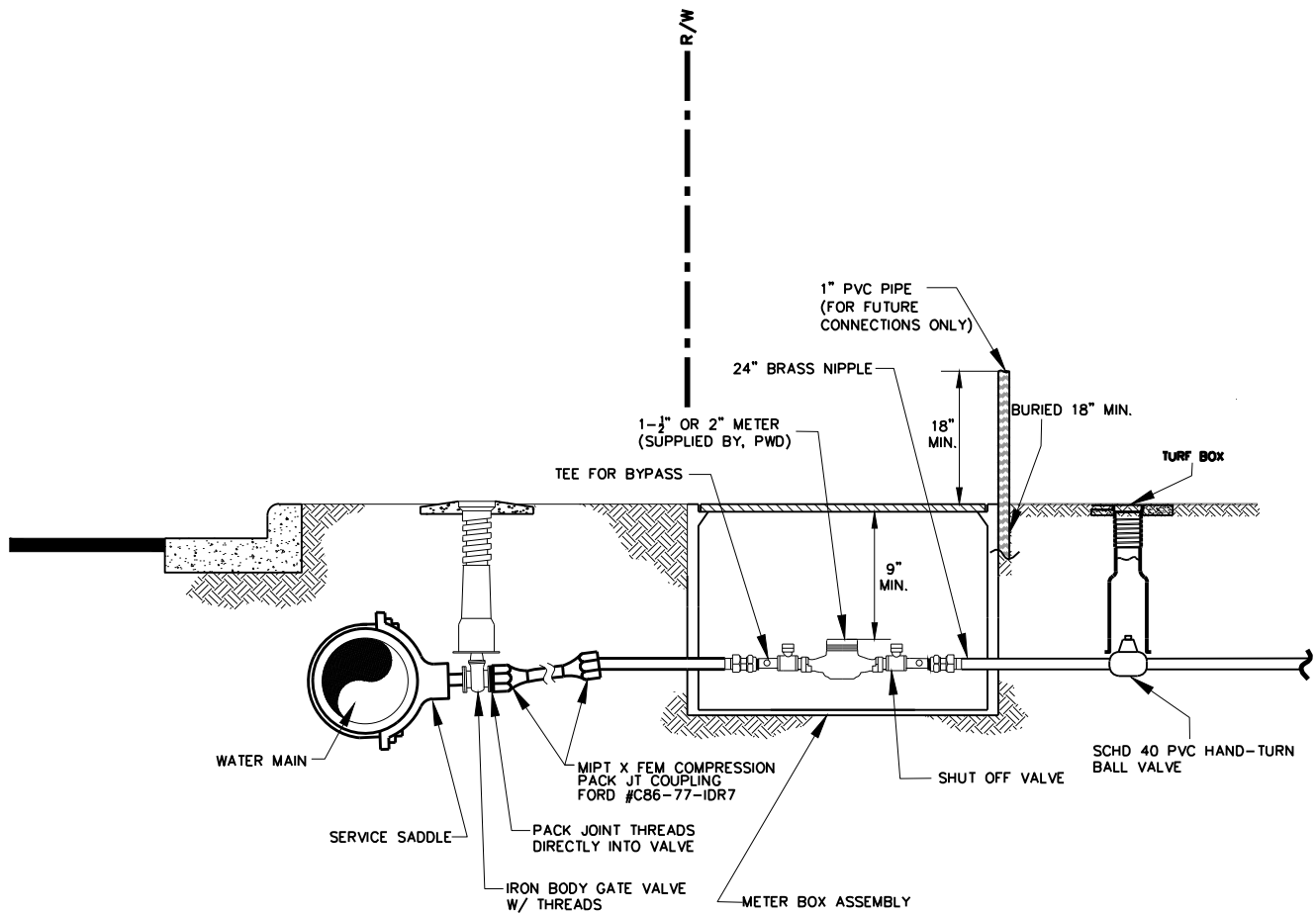
**TYPICAL 3/4" OR 1" WATER SERVICE
& METER CONNECTION
DETAIL**

DATE : JUNE 2022

SCALE : N.T.S.

JOB NO.: 02400-001

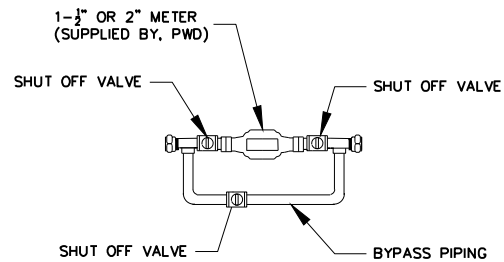
SHEET **STD-W-01**



SECTION VIEW

Size	Corporation Stop	Meter Box	Meter	Tubing
1-1/2" or 2"	Gate Valve, Resilient Seat AWWA 509 Full body DI or CI w/ bronze nipple (Mueller A-2360 or Clow 6100) or American 2500)	QUAZITE (1.5") 30x48x18 (2") 30x48x24 WITH READER AND PWD LOGO	Supplied by PWD	CL-200 PVC

SERVICE SADDLES	
Main	1-1/2" and 2" NPT outlets
2" - 8"	Smith Blair 317, Ford FC 202 or Romac 202S
>8"	Smith Blair 317, Ford FC 202 or Romac 202S



METER PLAN VIEW



POWDERSVILLE WATER

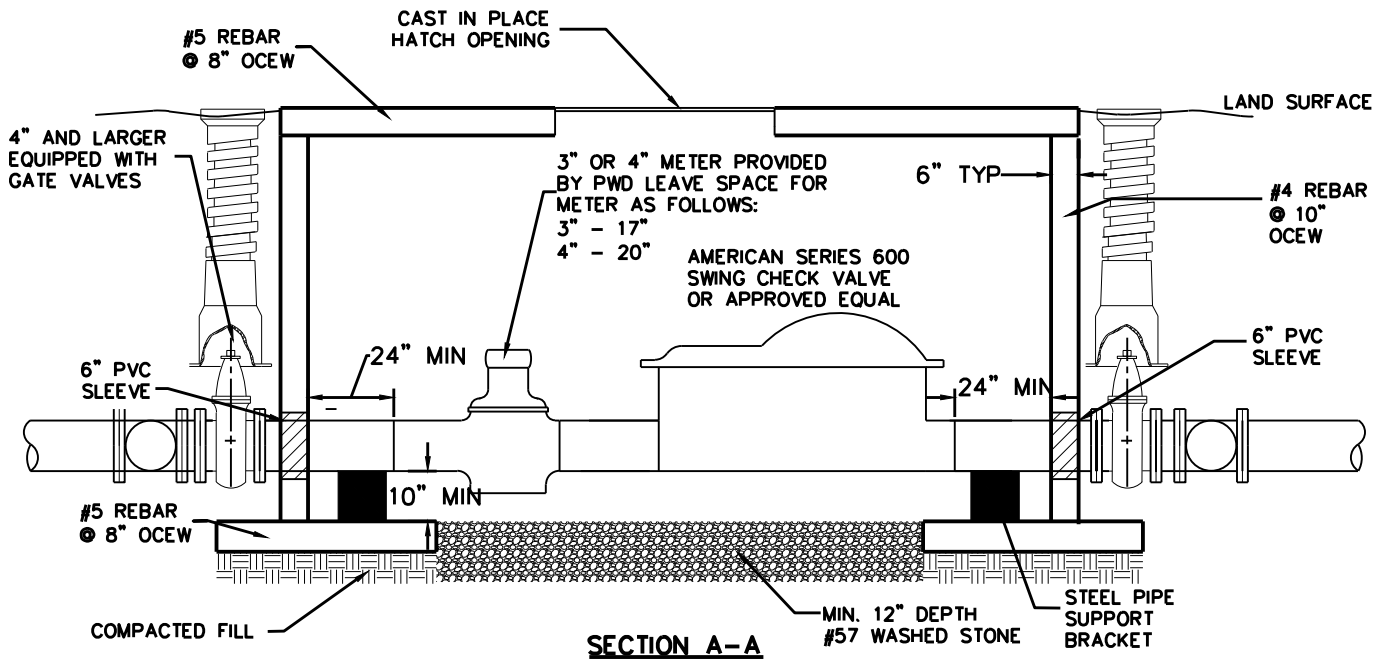
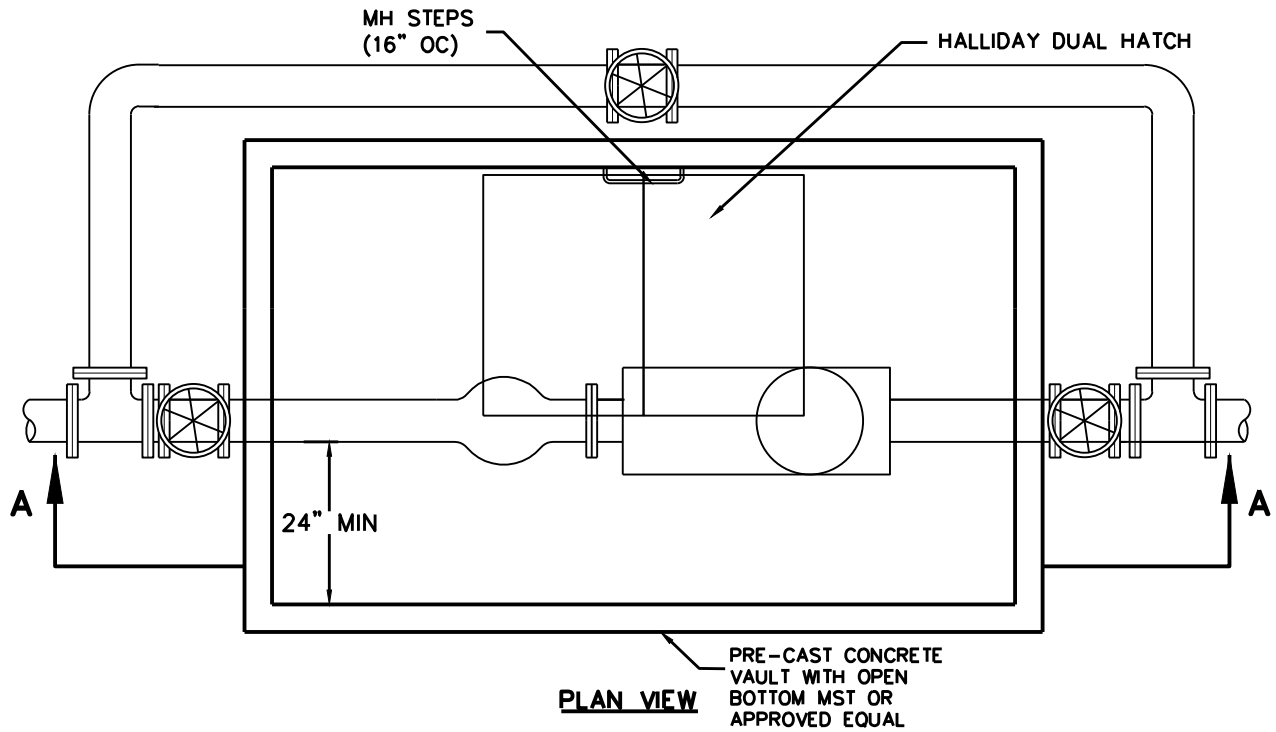
**1-1/2" AND 2" WATER SERVICE
& METER CONNECTION
DETAIL**

DATE : JUNE 2022

SCALE : N.T.S.

JOB NO.: 02400-001

SHEET **STD-W-02**



MIN INSIDE DIMENSIONS: 8' x 10' x 6'



POWDERSVILLE WATER

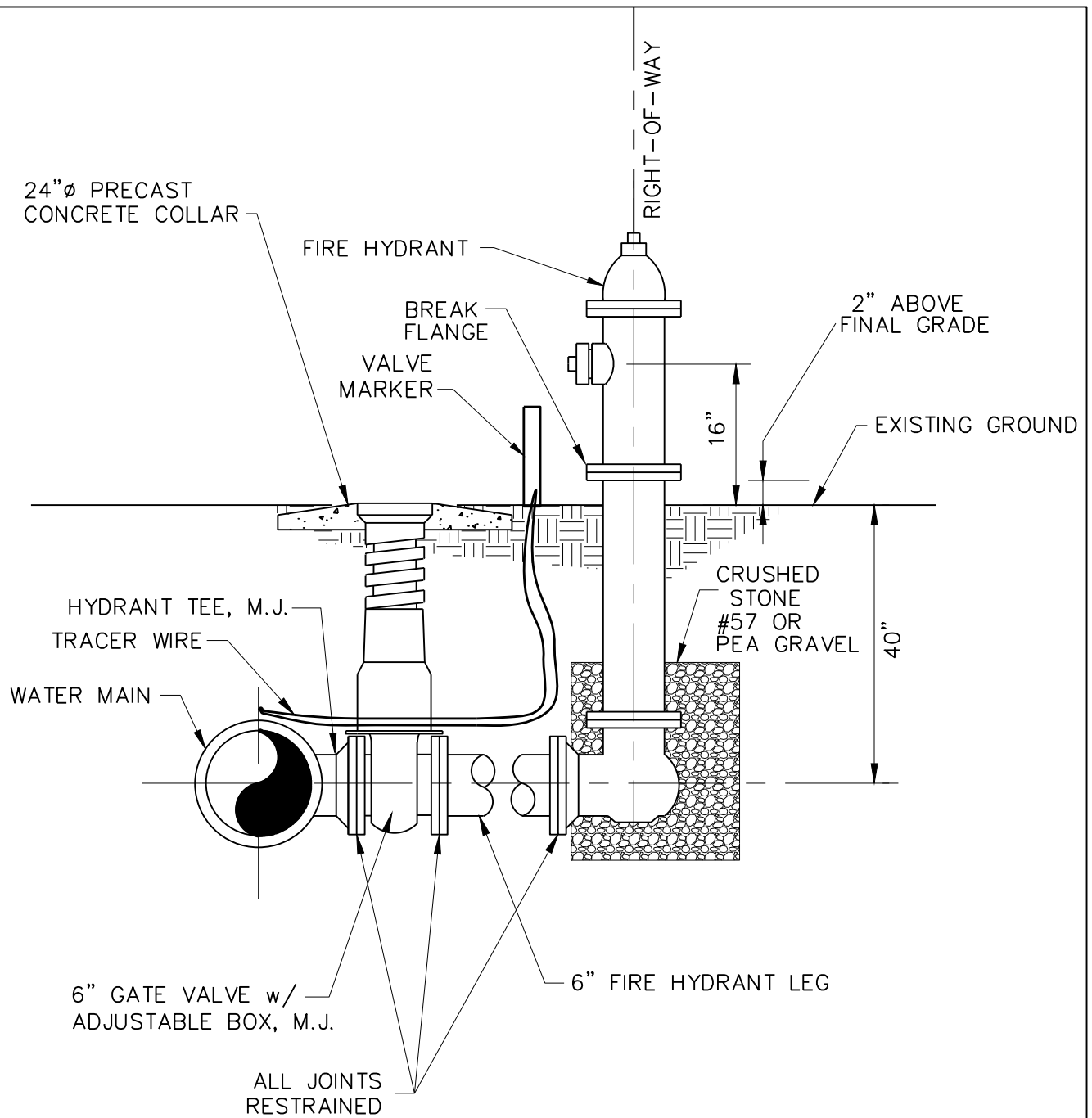
3" AND 4"
WATER SERVICE AND METER CONNECTION

DATE: JUNE 2022

SCALE: NTS

JOB #: 02400-001

SHEET: STD-W-03



POWDERSVILLE WATER

TYPICAL FIRE HYDRANT ASSEMBLY
DETAIL

DATE : JUNE 2022

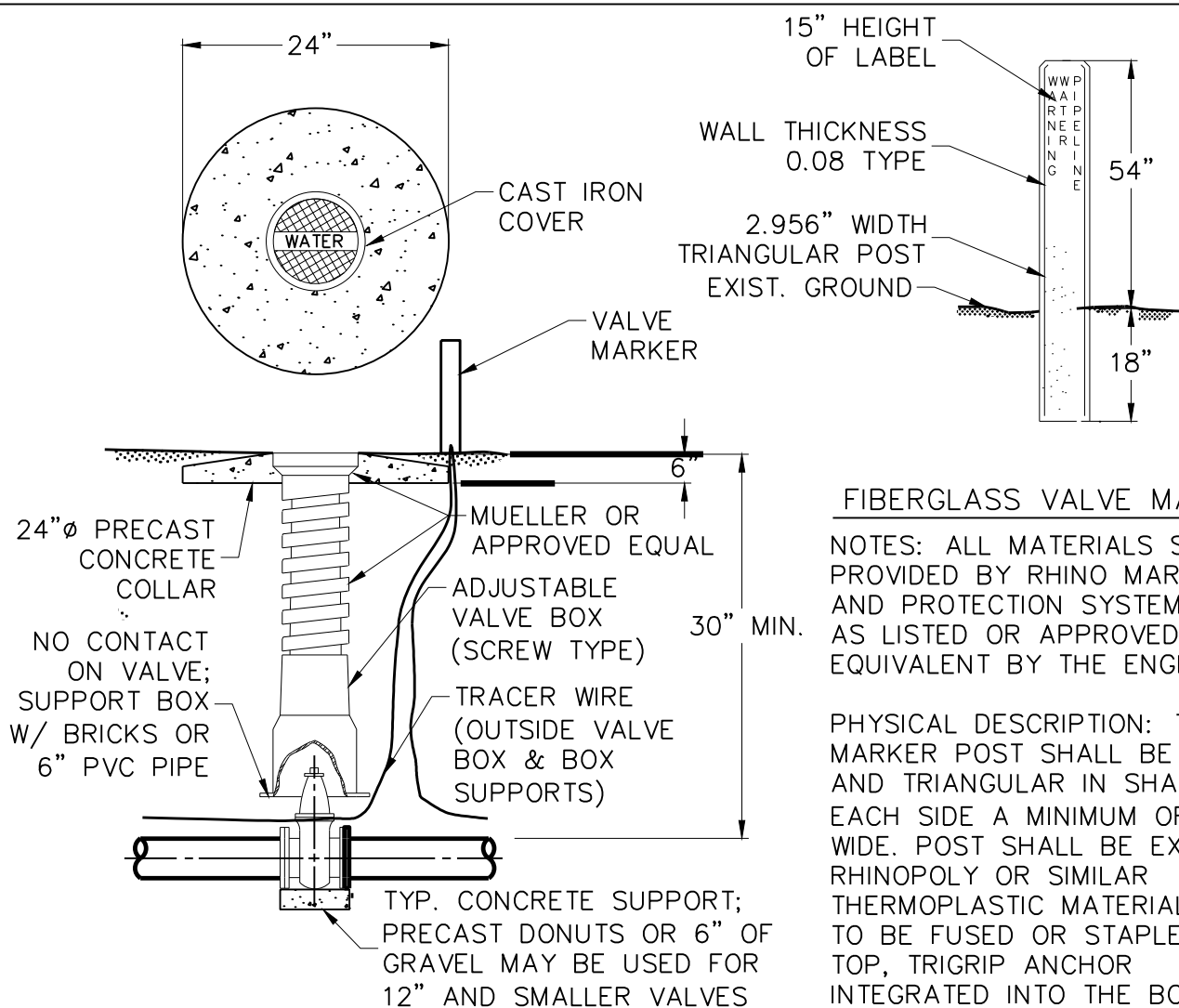
SCALE : N.T.S.

JOB NO.: 02400-001

SHEET STD-W-04



SHEET STD-W-05



FIBERGLASS VALVE MARKER

NOTES: ALL MATERIALS SHALL BE PROVIDED BY RHINO MARKING AND PROTECTION SYSTEMS INC., AS LISTED OR APPROVED EQUIVALENT BY THE ENGINEER.

PHYSICAL DESCRIPTION: THE MARKER POST SHALL BE BLUE AND TRIANGULAR IN SHAPE, WITH EACH SIDE A MINIMUM OF 3" WIDE. POST SHALL BE EXTRUDED RHINOPOLY OR SIMILAR THERMOPLASTIC MATERIAL. CAP TO BE FUSED OR STAPLED TO TOP, TRIGRIP ANCHOR INTEGRATED INTO THE BOTTOM OF EACH POST. OVERALL LENGTH DETERMINED BY SPECIFIC APPLICATION.

NOTES: 1) VALVE MARKERS SHALL BE MARKED AS FOLLOWS:
MV – MAIN VALVE
AV – AIR RELEASE VALVE
PIPELINE – PIPELINE MARKER
2) DO NOT WRAP WIRE AROUND VALVE NUT INSIDE VALVE BOX.

VALVE MODELS:

MUELLER A2360
CLOW 6100
AMERICAN 2500

MARKER PARTS LIST:

RHINO #TVF72UB –
RHINO TRIVIEW FLEX,
72" BLUE WITH BLACK CAP
DECAL RHINO PART #GD8-1332K

PERFORMANCE: MARKER POST SHALL BE UV STABLE AND CAPABLE OF WITHSTANDING DIRECT SUNLIGHT FOR AT LEAST 10 YEARS WITHOUT CRACKING OR SIGNIFICANT FADING. POST INSTALLED VIA DIRECT BURY WILL WITHSTAND IMPACTS AT SPEEDS OF UP TO 60 MPH AND RETURN TO STANDING. POST SHALL BE CORONA OR FLAME TREATED PRIOR TO DECAL INSTALLATION TO ENSURE MAXIMUM ADHESION. DECALS SHALL NOT SIGNIFICANTLY FADE, CRACK, OR CURL FOR AT LEAST 10 YEARS.

INSTALLATION: POST SHALL BE INSTALLED VIA DIRECT BURY. HOLE MUST BE AT LEAST 6" IN DIAMETER AND 18" DEEP. ANCHOR FLAPS TO BE EXTENDED AND SOIL COMPACTED TO COMPLETE INSTALLATION.



POWDERSVILLE WATER

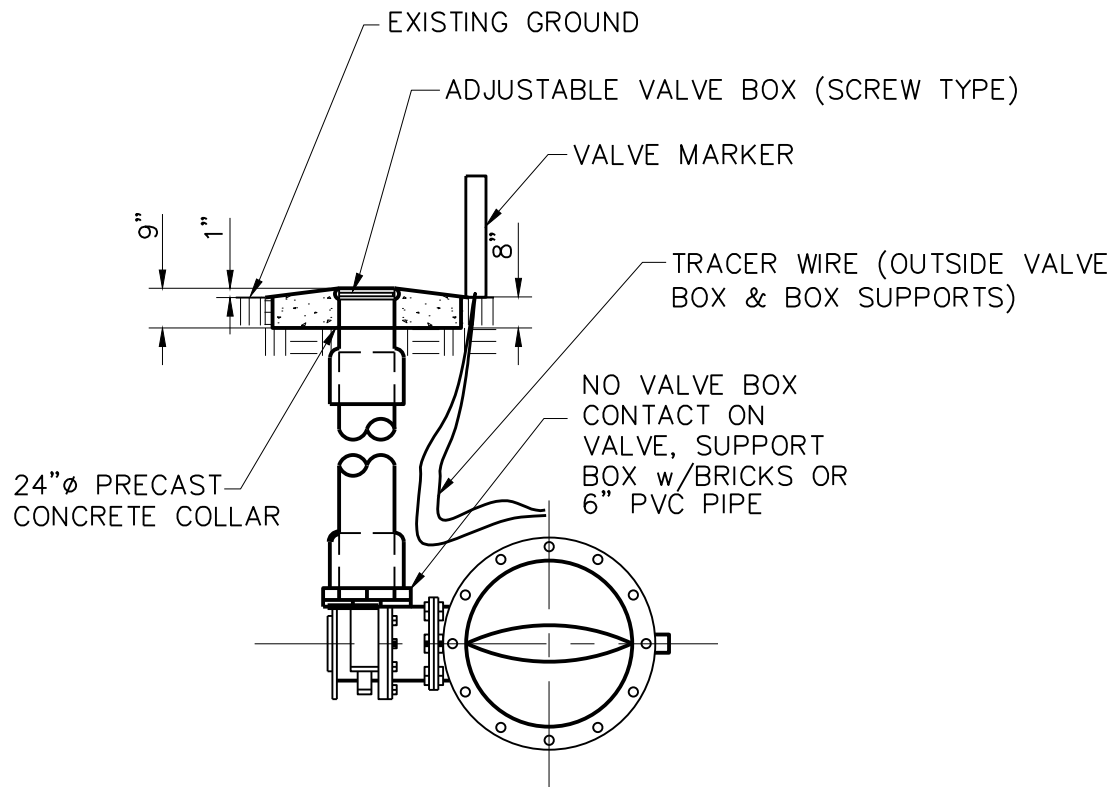
GATE VALVE
DETAIL

DATE : JUNE 2022

SCALE : N.T.S.

JOB NO.: 02400-001

SHEET STD-W-06



MODELS:

PRATT/MUELLER – LINESEAL III
 CLOW 4500 SERIES
 DEZURIK AWWA C504

BUTTERFLY VALVE DETAIL

N.T.S.



POWDERSVILLE WATER

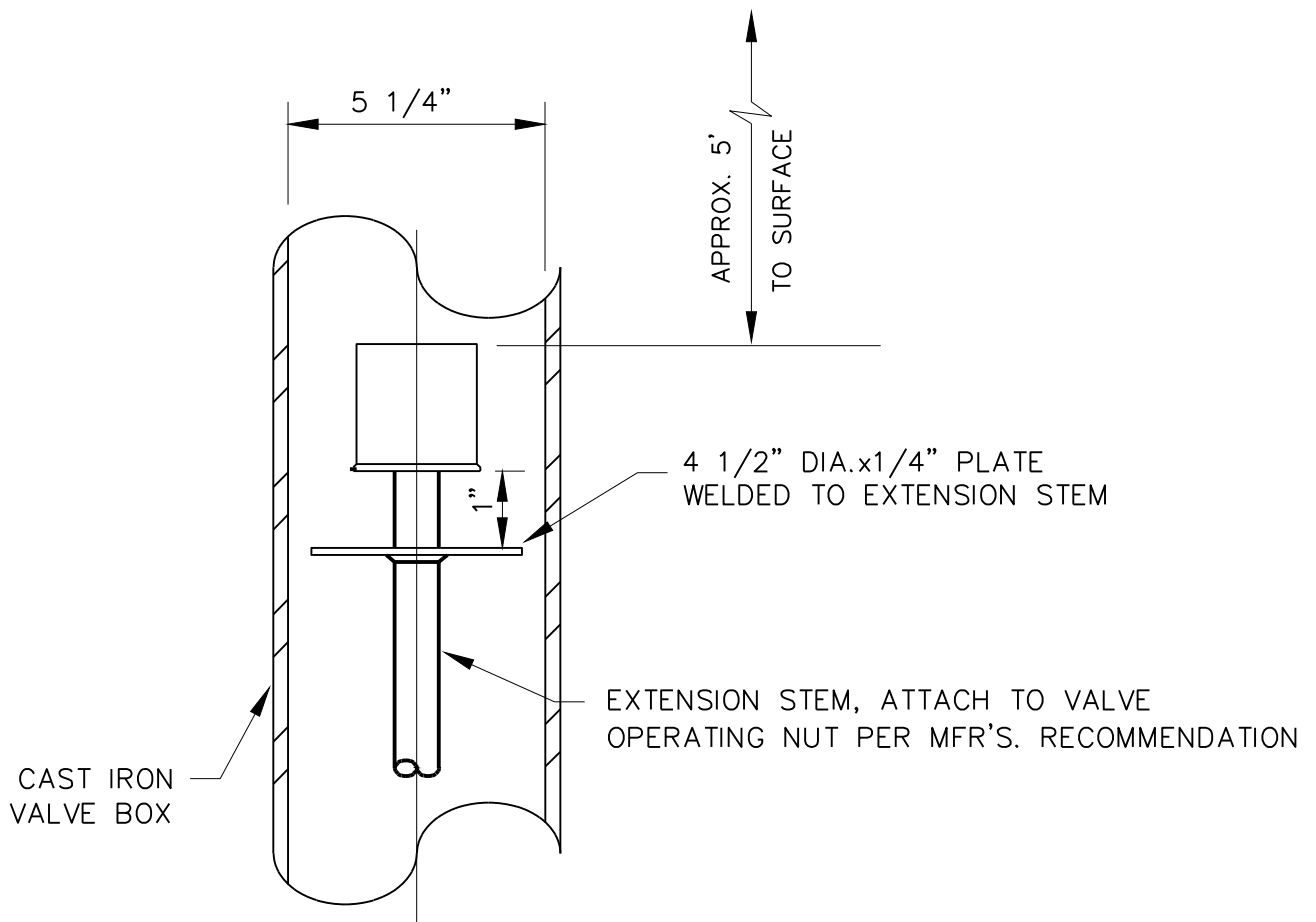
BUTTERFLY VALVE
 DETAIL

DATE : JUNE 2022

SCALE : N.T.S.

JOB NO.: 02400-001

SHEET STD-W-07



NOTE:
ANY VALVE OVER 4' IN DEPTH
REQUIRES EXTENSION STEM TO BE
PERMANENTLY INSTALLED.



POWDERSVILLE WATER

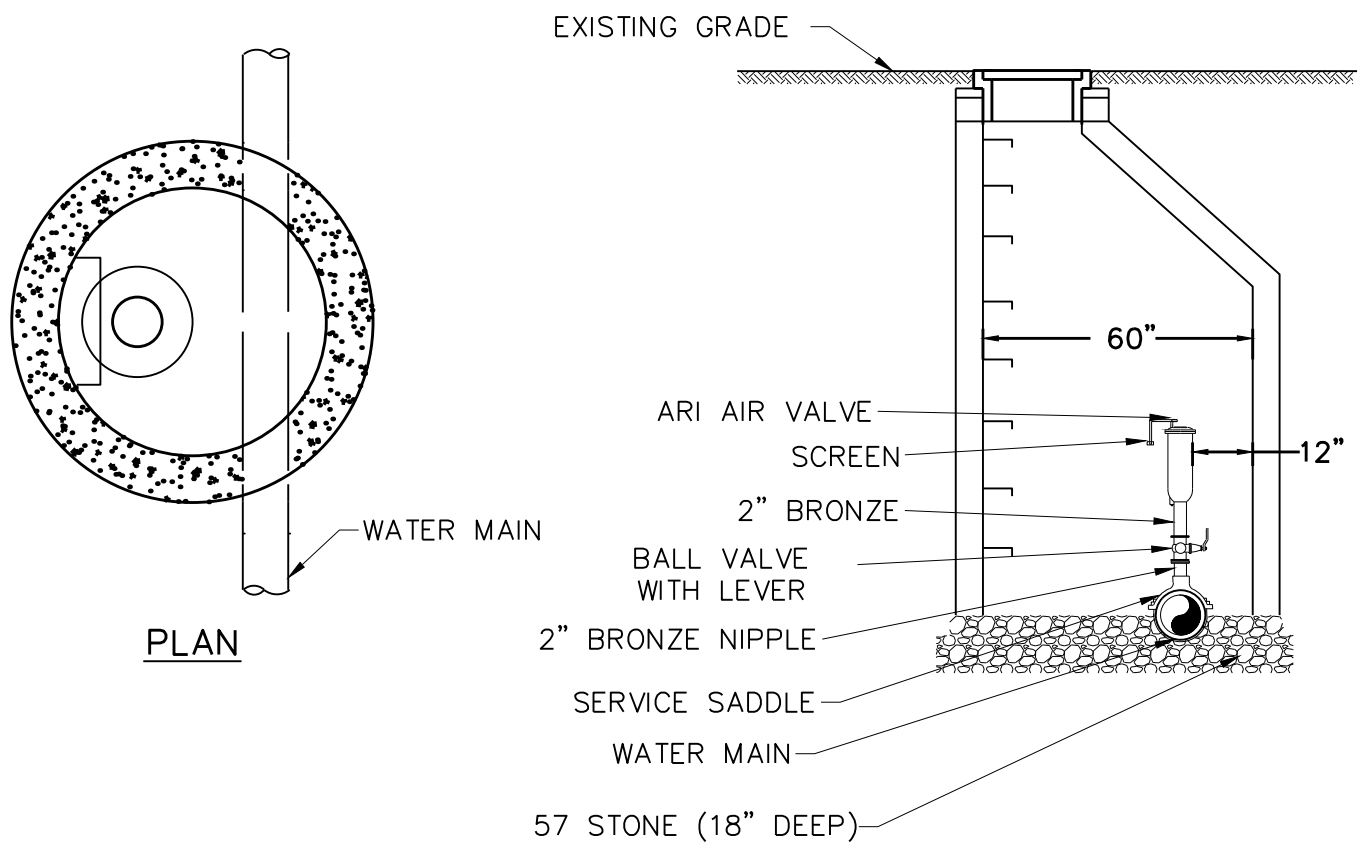
EXTENSION STEM
DETAIL

DATE : JUNE 2022

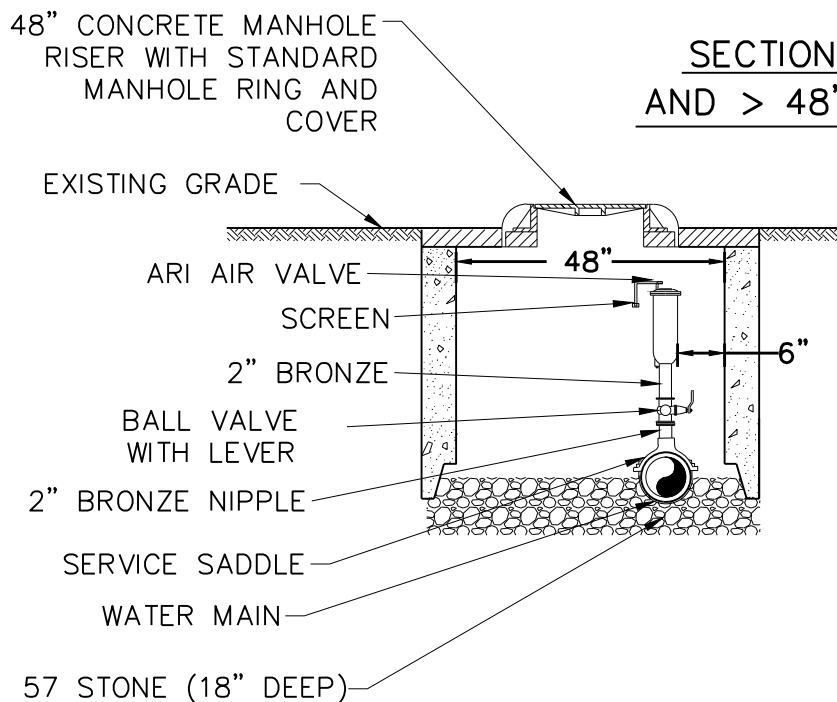
SCALE : N.T.S.

JOB NO.: 02400-001

SHEET STD-W-08



SECTION (MAIN > 12" DIAMETER
AND > 48" DEPTH TO TOP OF PIPE)



SECTION (MAIN < 12" DIAMETER)

NOTES:

1. SET MANHOLE COVER 2" ABOVE NATURAL GRADE OR FLUSH WITH PAVING.
2. MANHOLE SHALL BE 48" DIAMETER.
3. STYLE MAY VARY- ACTUAL CONFIGURATION TO BE DETERMINED BY ENGINEER.



POWDERSVILLE WATER

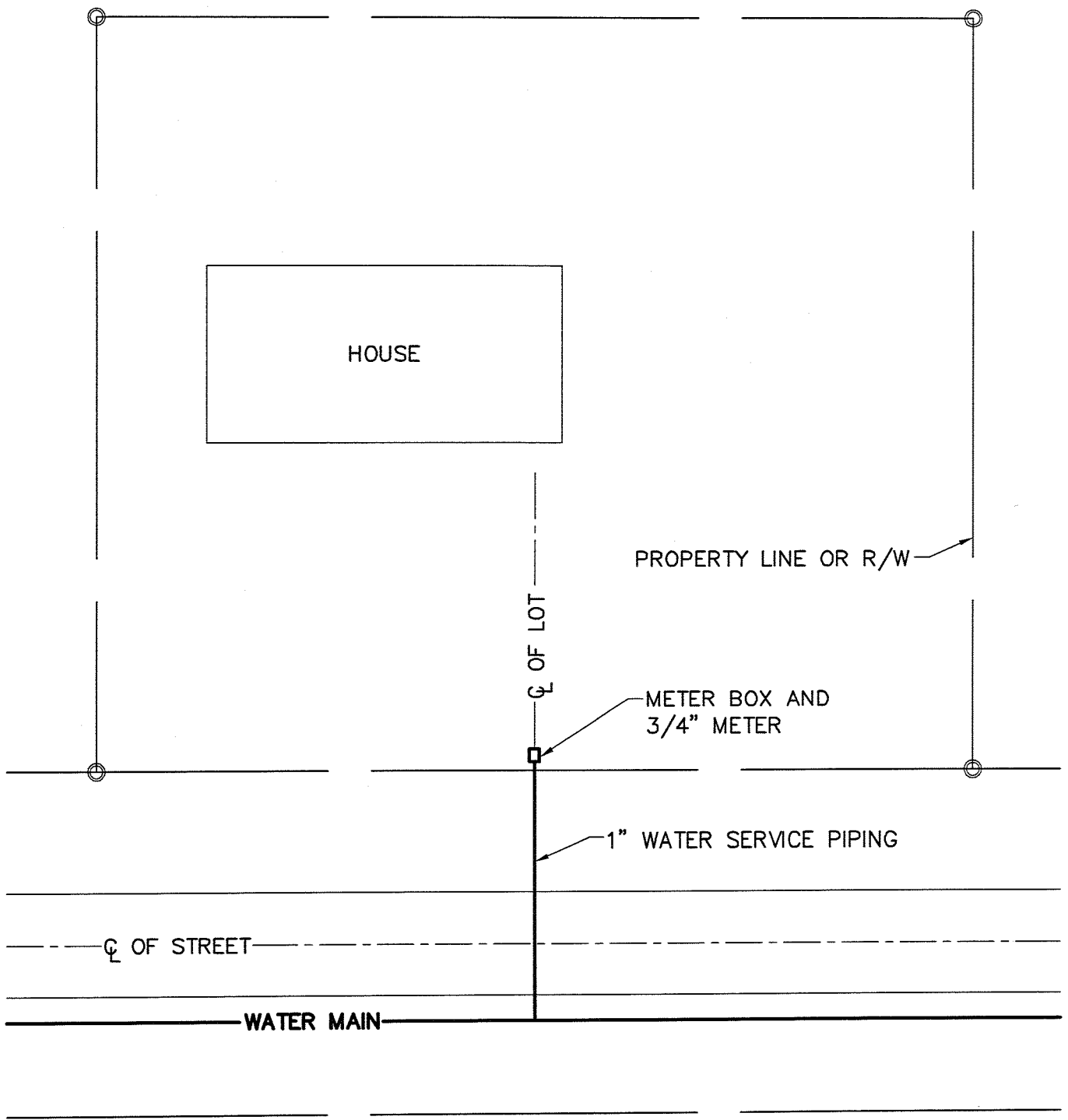
AIR RELEASE/VACUUM VALVE
DETAIL

DATE : JUNE 2022

SCALE : N.T.S.

JOB NO.: 02400-001

SHEET STD-W-09



POWDERSVILLE WATER

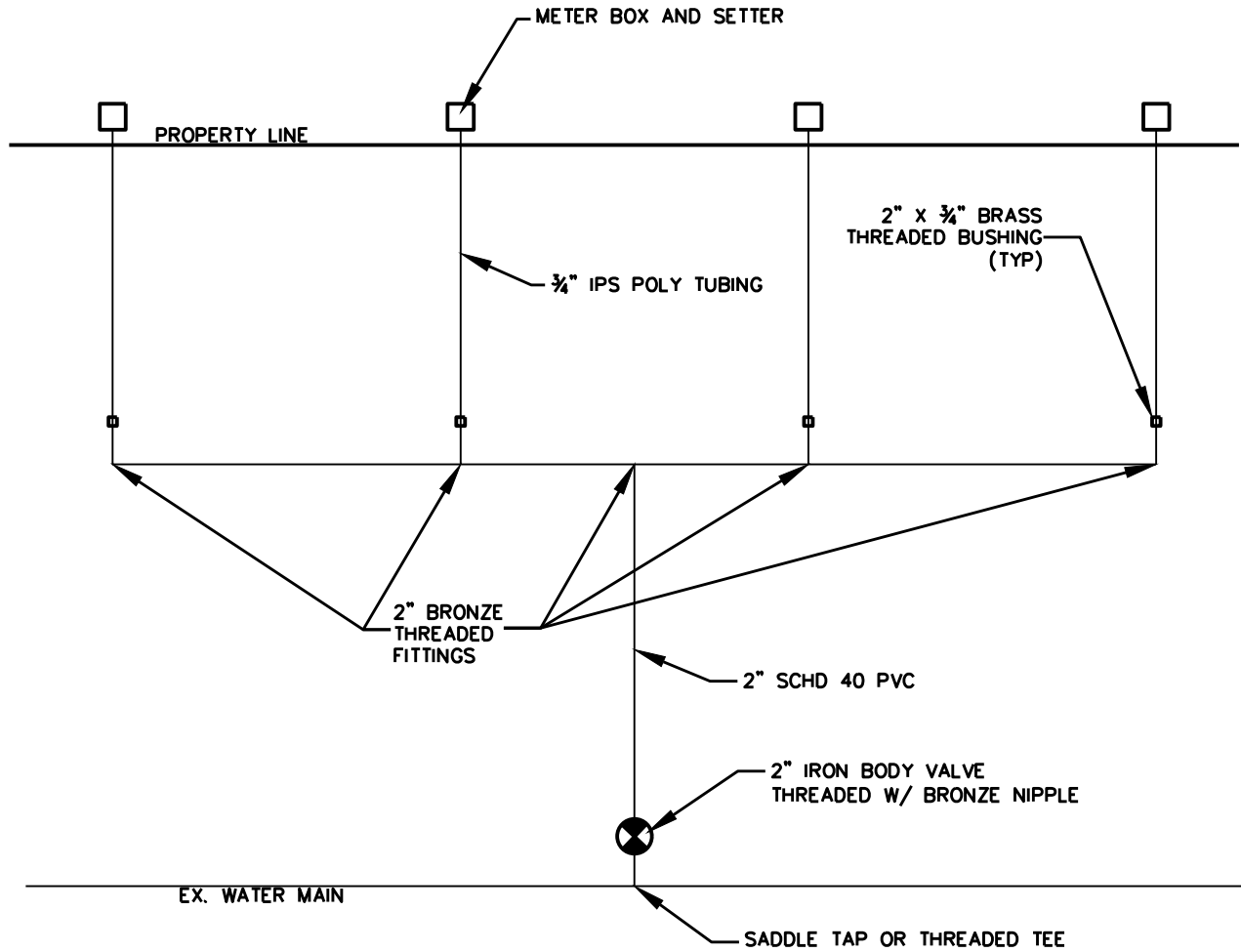
RESIDENTIAL TAP PLACEMENT
DETAIL

DATE : JUNE 2022

SCALE : N.T.S.

JOB NO.: 02400-001

SHEET STD-W-10



NOTES:

1. ALL JOINTS AT BRASS THREADED FITTINGS SHALL INCLUDE EITHER THREADED BRASS NIPPLE SCREWED INTO FITTING OR A MIPT X FEM. COMPRESSION ADAPTER (FORD C86-77-1DR7 OR EQUIVALENT)
2. MULTIPLE METER HEADER ASSEMBLIES ARE TO BE UTILIZED WHEN 3 OR MORE METERS ARE TO BE INSTALLED NO MORE THAN 6 METERS SHALL BE INSTALLED ON ANY 2" HEADER ASSEMBLY.



POWDERSVILLE WATER

MULTIPLE METER HEADER ASSEMBLY DETAIL

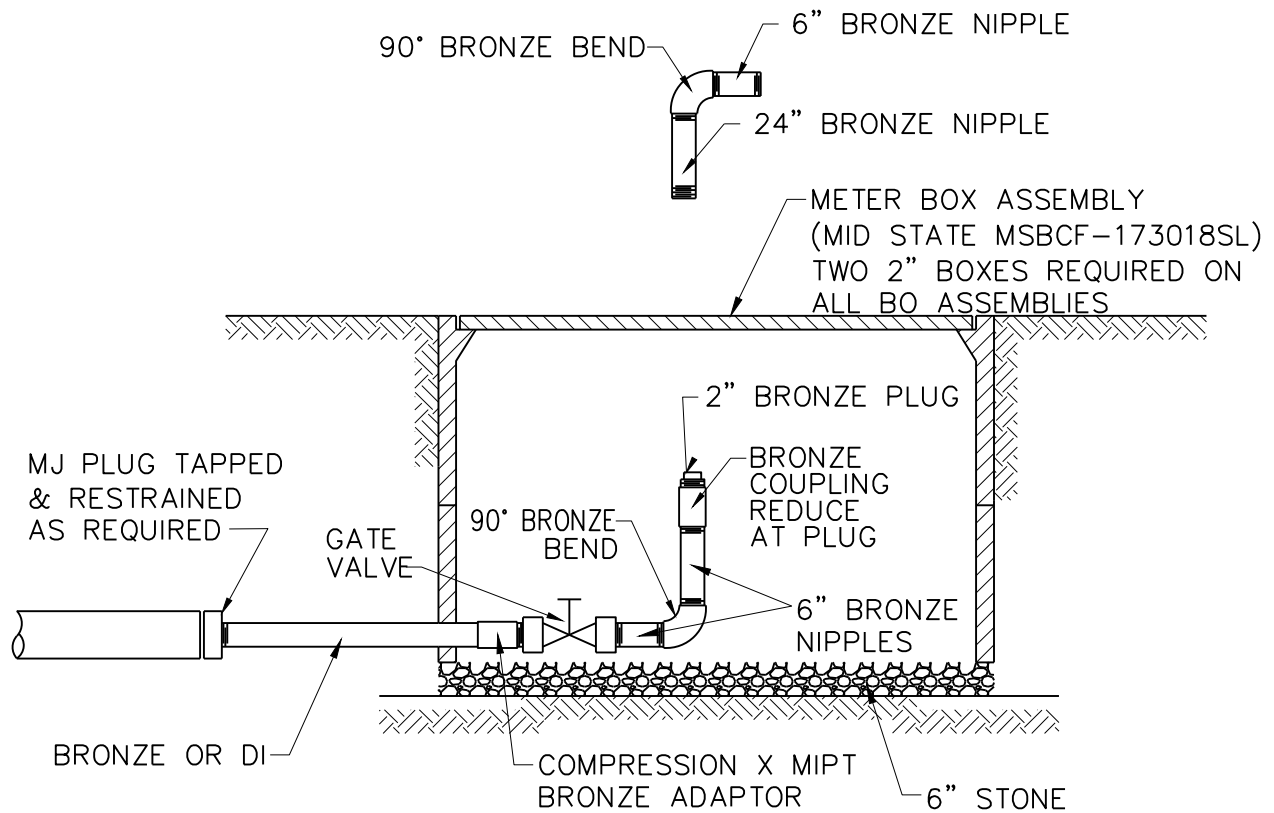
DATE: JUNE 2022

SCALE: NTS

JOB #: 02400-001

SHEET: STD-W-11

FURNISH ONE 2" ASSEMBLY PER
BLOWOFF & STORE IN BOX



POWDERSVILLE WATER

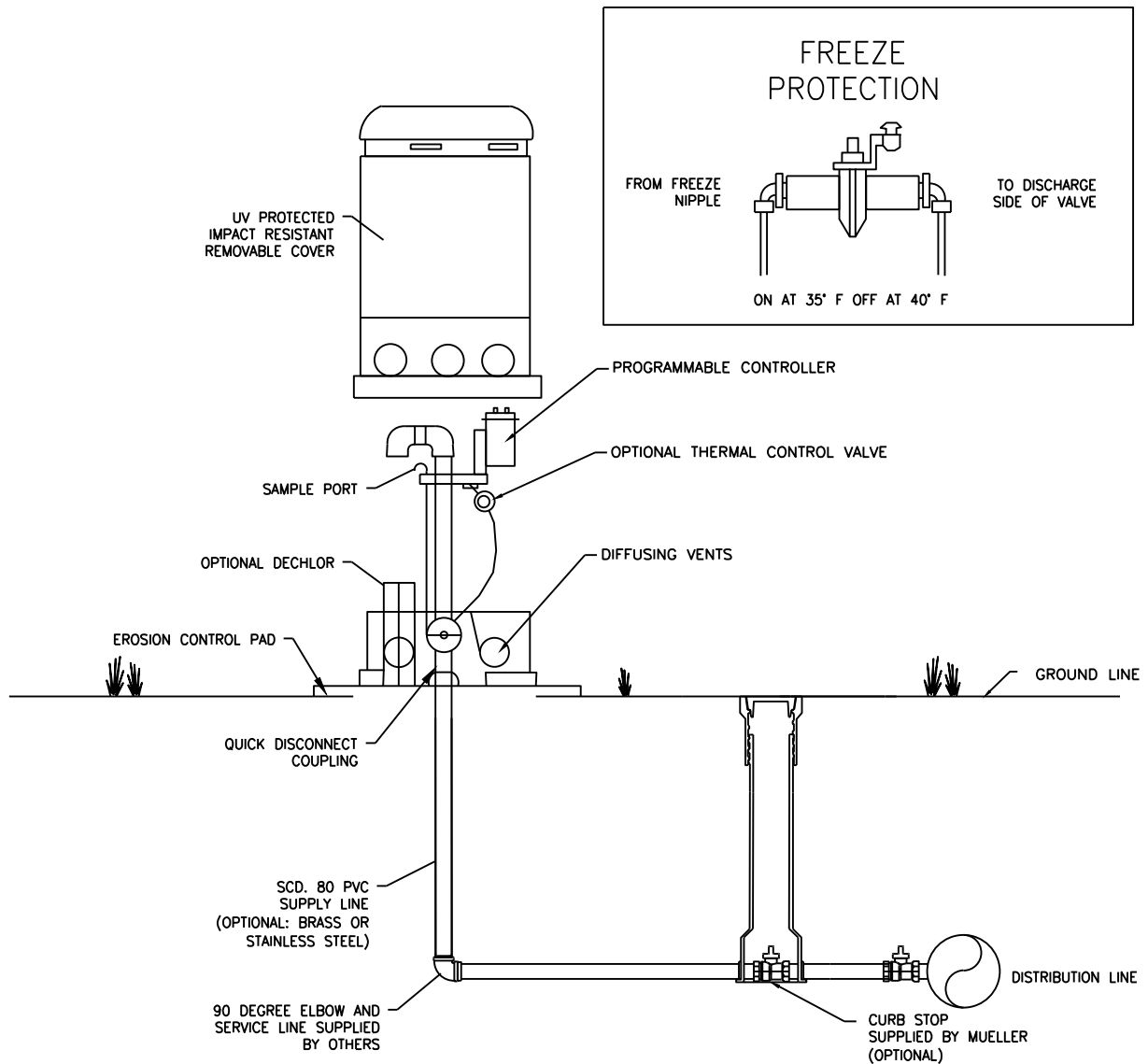
TYPICAL BLOW-OFF ASSEMBLY
DETAIL

DATE : JUNE 2022

SCALE : N.T.S.

JOB NO.: 02400-001

SHEET STD-W-12



*AUTOMATIC FLUSHING DEVICE SHALL BE KUPFERLE ECLIPSE #9700 OR APPROVED EQUIVALENT

IF MULTIPLE CUL-DE-SACS (DEAD ENDS) ARE PROPOSED MUST HAVE 1 FLUSHING DEVICE PER 25 LOTS – LOCATION DETERMINED BY PW



POWDERSVILLE WATER

AUTOMATIC FLUSHING
DEVICE DETAIL

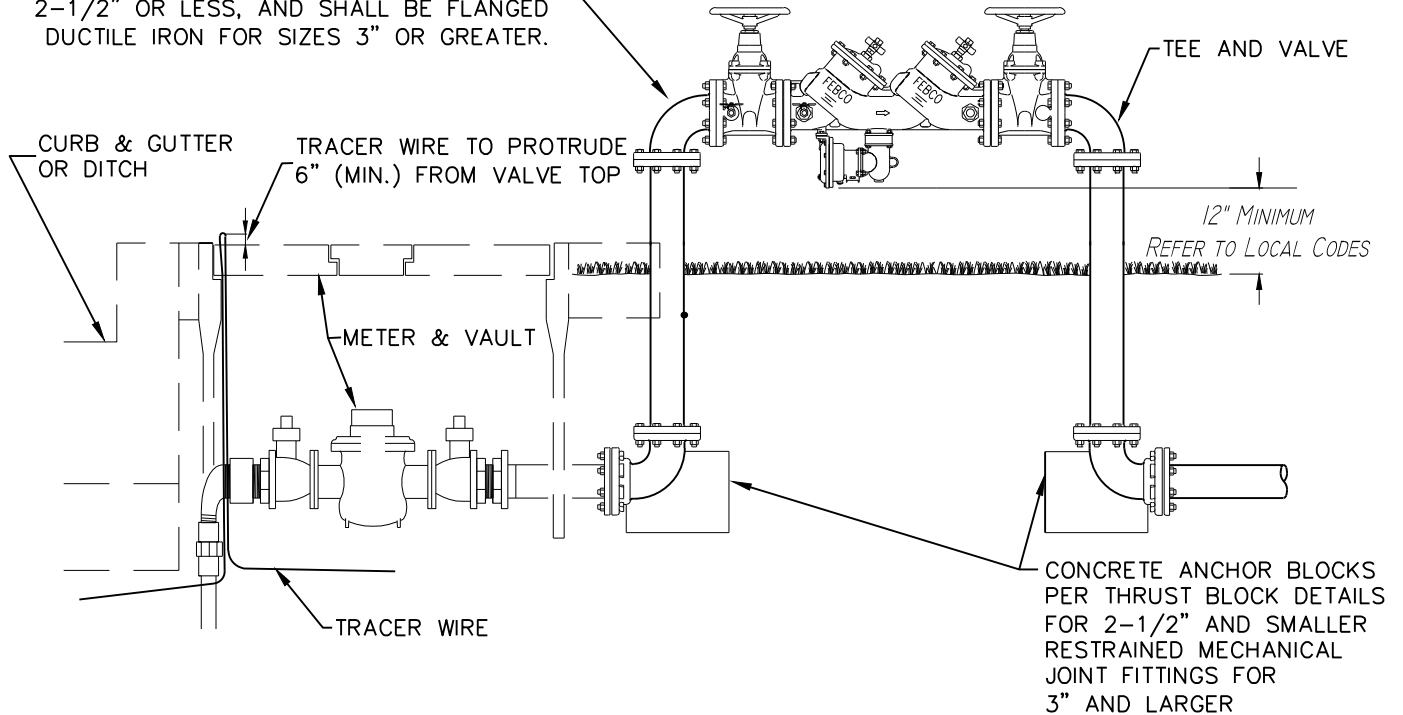
DATE : JUNE 2022

SCALE : N.T.S.

JOB NO.: 02400-001

SHEET STD-W-13

PIPING, VALVES, NIPPLES, ETC. SHALL BE
THREADED GALVANIZED PIPE FOR SIZES
2-1/2" OR LESS, AND SHALL BE FLANGED
DUCTILE IRON FOR SIZES 3" OR GREATER.



NOTES:

1. REDUCED-PRESSURE BACKFLOW PREVENTION DEVICES SHALL BE REQUIRED FOR ANY USE WHERE TOXIC MATERIALS ARE USED OR WHERE POSITIVE PROTECTION FOR THE PUBLIC WATER SUPPLY IS REQUIRED. TYPICAL APPLICATIONS INCLUDE: HOSPITALS, MEDICAL & DENTAL LABS, MORTUARIES, INDUSTRIAL PLANTS, DRY CLEANERS, OR AS DETERMINED BY PWD.
2. APPROVED BACKFLOW PREVENTION DEVICES SHALL BE AS LISTED BY PWD.
3. BACKFLOW PREVENTION DEVICES SHALL BE INSTALLED ADJACENT TO AND ON PROPERTY SIDE OF SIDEWALK WHERE APPLICABLE. WHERE NO SIDEWALK EXISTS, THE ASSEMBLY SHALL BE INSTALLED AS CLOSE AS POSSIBLE TO THE WATER METER LOCATION UNLESS A MECHANICAL ROOM WITH POSITIVE DRAINAGE IS PROVIDED IN THE BUILDING. FINAL LOCATION TO BE APPROVED BY PWD PRIOR TO INSTALLATION.
4. SCREENING AND LANDSCAPING PLACES AROUND DEVICE SHALL ALLOW FOR ACCESS BY PWD PERSONNEL.
5. FREEZE PROTECTION IS THE OWNERS RESPONSIBILITY. A DEVICE SUCH AS A "HOT BOX" IS HIGHLY RECOMMENDED.



POWDERSVILLE WATER

REDUCED PRESSURE BACKFLOW
PREVENTOR DETAIL

DATE : JUNE 2022

SCALE : N.T.S.

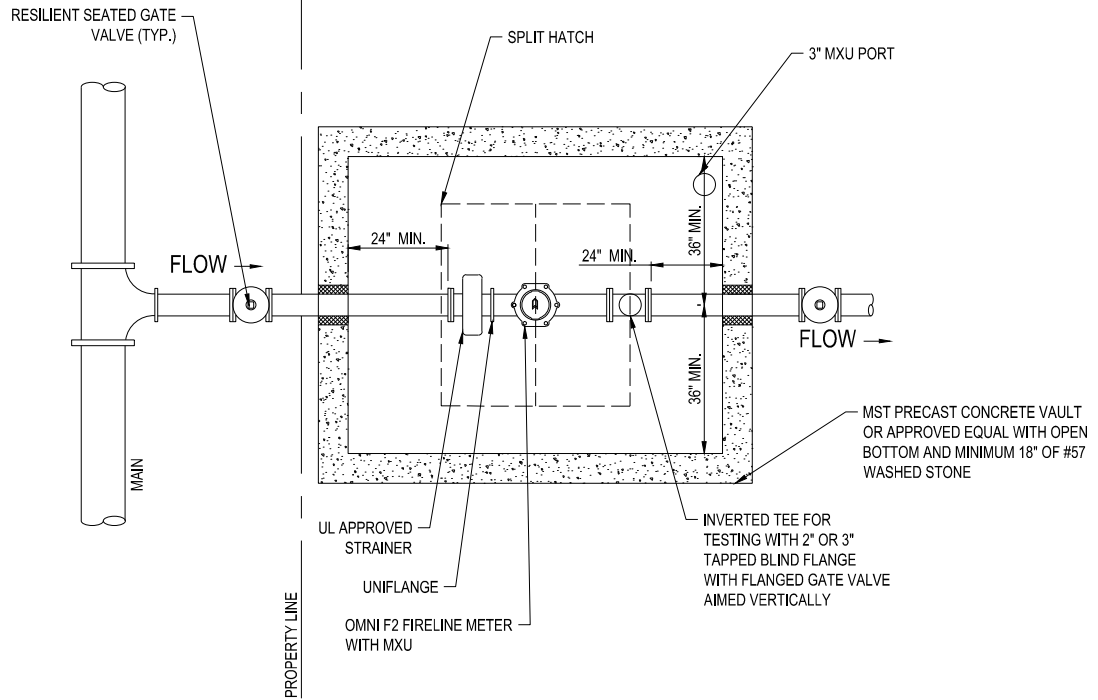
JOB NO.: 02400-001

SHEET STD-W-14

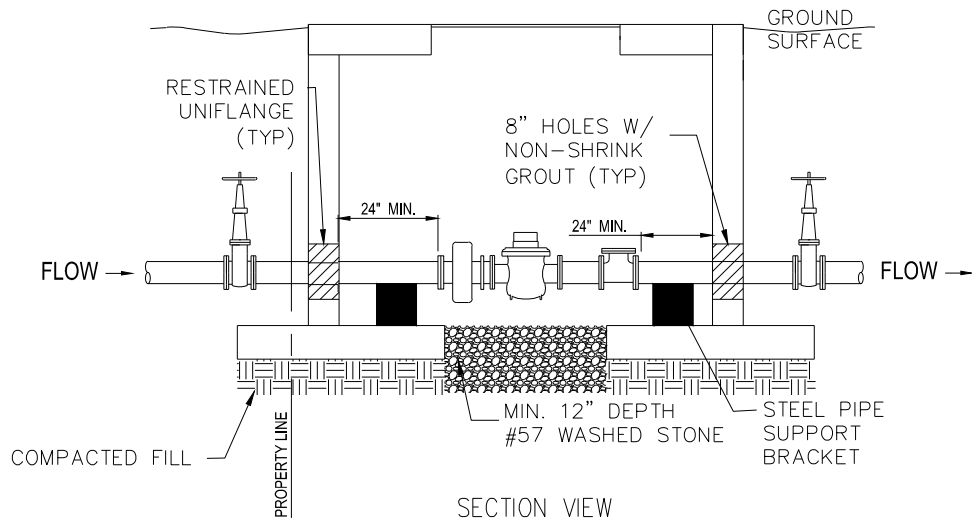


VAULT SIZE MIN INSIDE DIMENSIONS	
10"	10' x 8' x 6'
8"	10' x 8' x 6'
6"	8' x 8' x 6'
4"	8' x 6' x 6'

SHEET: STD-W-16



PLAN VIEW



SECTION VIEW



POWDERSVILLE WATER

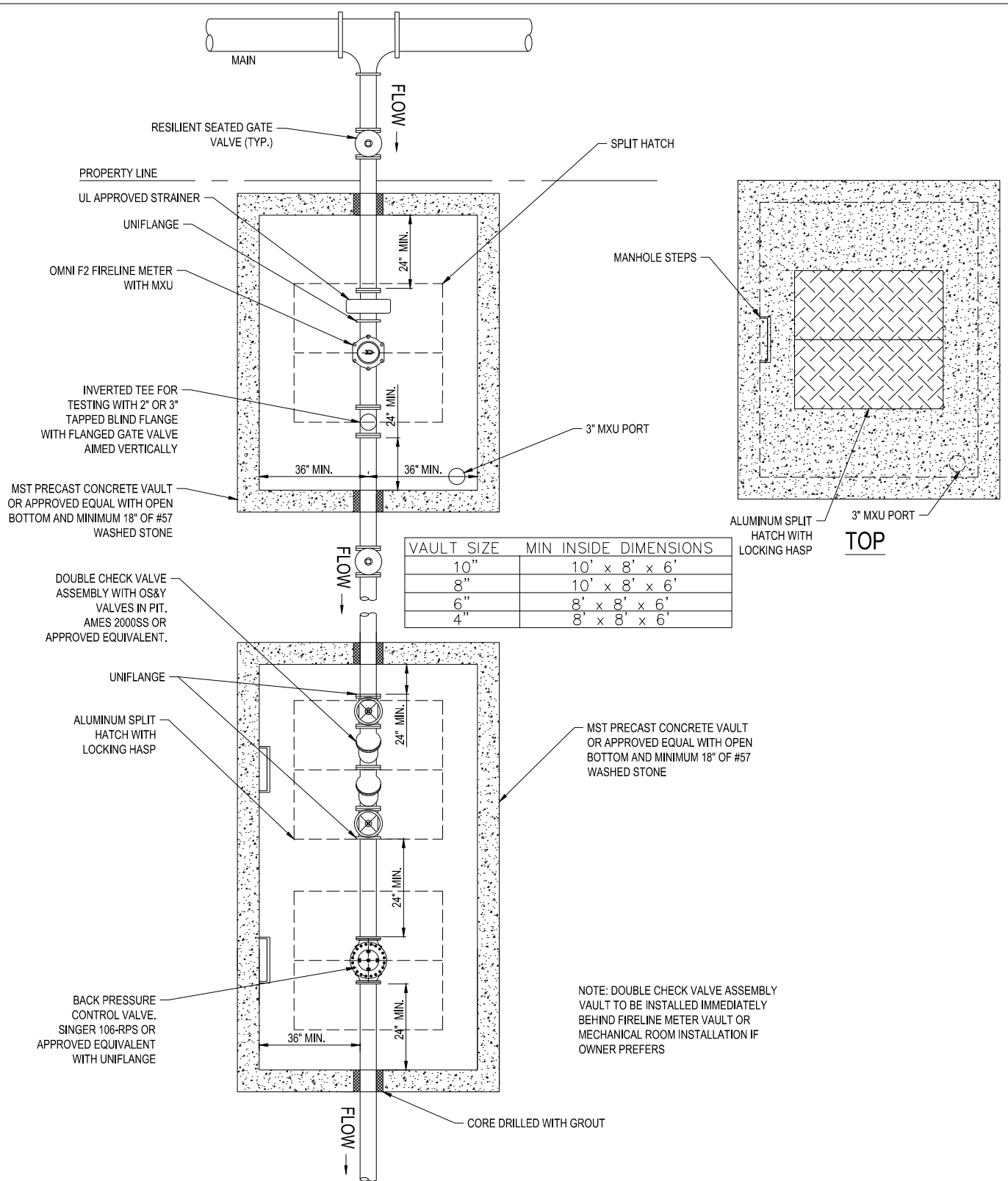
METERED FIRE LINE VAULT

DATE : JUNE 2022

SCALE : N.T.S.

JOB NO.: 02400-001

SHEET STD-W-17



POWDERSVILLE WATER

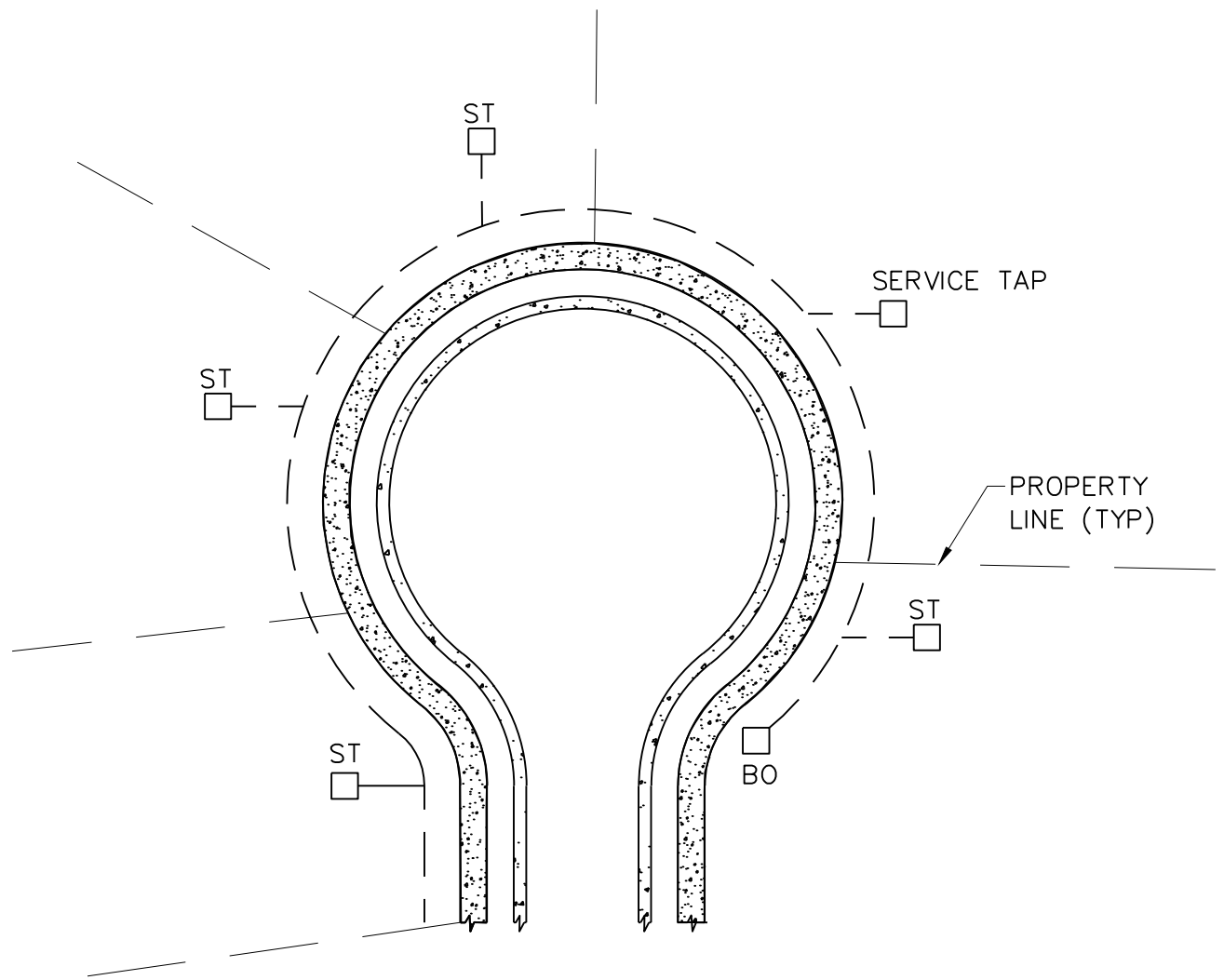
METERED FIRE LINE

DATE : JUNE 2022

SCALE : N.T.S.

JOB NO.: 02400-001

SHEET STD-W-17



ALL SERVICES NOT TAPPED STRAIGHT IN LINE WITH METER BOX, MUST HAVE WIRE INSTALLED WITH SERVICE LINE



POWDERSVILLE WATER

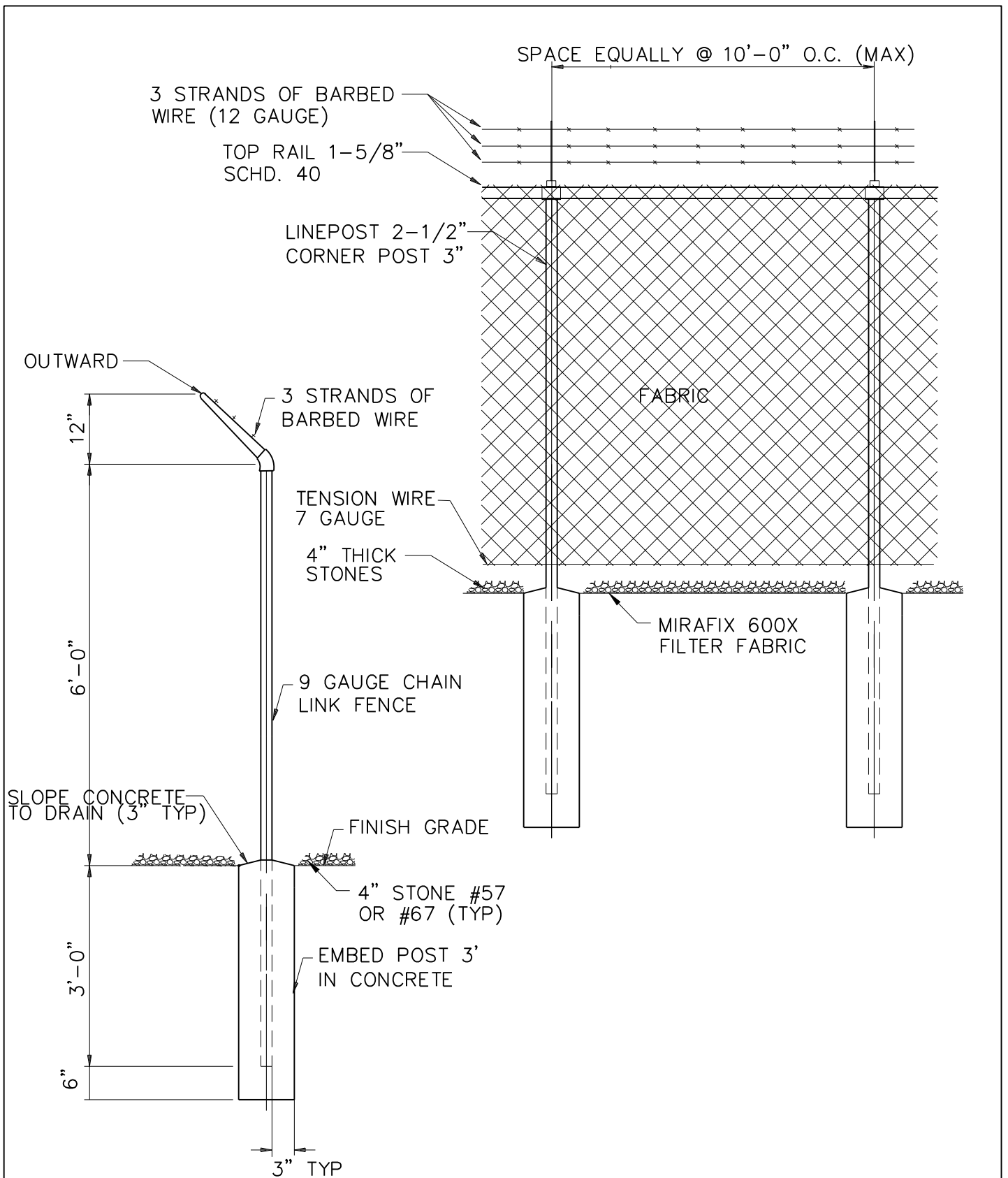
CUL-DE-SAC
DETAIL

DATE : JUNE 2022

SCALE : N.T.S.

JOB NO.: 02400-001

SHEET STD-W-18



POWDERSVILLE WATER

FENCE
DETAIL

DATE : JUNE 2022

SCALE : N.T.S.

JOB NO.: 02400-001

SHEET STD-W-19